What Adequate Lighting Means in Industrial Management—Articles on Public Policy Methods and Questions Affecting Central Stations

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Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN
Published by the McGraw-Hill Publishing Company, Inc.

Vol. 69 NEW YORK, SATURDAY, JUNE 2, 1917 No. 22

Engineers to the Front

WE ARE glad to see the vigorous efforts now being made to recruit and dispatch to France at the earliest possible moment a large force of engineers to deal with the great problems of transportation and reconstruction that lie before the Allies as they advance through the most ghastly desert that the eye of man has ever dwelt upon. Rehabilitation will very likely fall in chief upon American engineers. The recruiting and training of soldiers is a very slow task even when adequate preparations have been made, but engineer regiments are already trained to cope with hostile nature successfully, and employed as they will be behind the immediate firing line, the military side of their training need not be long drawn out. Let us have them then, these regiments of engineers, just as fast as they can be recruited and made ready, to make up as best we can for a signal failure in readiness with trained soldiers.

The Function of the Jobber

THE electrical supply jobbers of the country are gradually finding themselves. By that we do not mean to infer that they have not always been alive to the opportunities of their business, but that the members of the Electrical Supply Jobbers' Association are now taking a larger and more comprehensive view of jobbing affairs. Heretofore their actions have not been entirely void of friction begotten of bias and sectional feeling, whereas now there is a spirit of broad co-operation and co-ordination manifesting itself. This makes for stronger organization, greater efficiency, and, what is more important, it means that the jobbers are becoming better merchants. They are appreciating market conditions—the necessity of watching the market and providing against its idiosyncrasies by setting aside ample reserves. These conditions a few progressive jobbers have always had in mind, with the result that if their judgment was good they were successful. Now the lesson is being learned by nearly all. When the happy time comes (and indications are that it is not far distant) in which jobbers will fulfill to perfection their economic function in the chain of distribution between the manufacturer and the central station, dealer and contractor, there will be no question about their general recognition as distributers. They must, however, first attain a position to render an invaluable and indispensable service to manufacturer and consumer before they can reap the benefits which go with such a position. We are glad to observe the rapidity with which they are approaching that goal and the desire to get together with the rest of the industry.

The Stabilizer in Business

"KNOW thyself" is one of the fundamentals of right living. "Know your costs" is the first principle for the electrical manufacturer who does not want to blunder his way into bankruptcy. In the days before the Federal Trade Commission came into existence and friendly power it was the fashion to poke fun at Washington attempts to teach business anything. But that commission, conceived in a new spirit of helpfulness, has been a lever of tremendous importance to the business of the country, groping toward uniform accounting and cost systems. The Electrical Manufacturers' Council is especially to be congratulated that the system upon which its committee has worked for nearly a year has received the commendation of the Federal Trade Commission. True cost accounting is the best promoter of sound trade practices, the best stabilizer of business. With the information which it gives, the manufacturer makes no prices in ignorance of what he does. He may cut prices below cost, but if he does he knows that he will have to charge the difference to surplus or advance selling prices on other transactions enough to overcome the deficit. Behind the Electrical Manufacturers' Council in the sound accounting movement stand the three great organizations of manufacturers in the industry; behind all stands the Federal Trade Commission with creditor banks looming in the background demanding adherence to approved methods. Sooner or later the swift industrial pace of pre-war and wartime days will be followed by unsettled conditions in which rigid cost accounting will be the salvation of business, big or little.

Strafing the Submarine

THE newspaper inventor has been having the time of his life recently, owing to the very unwise chatter of certain worthy gentlemen who ought to know better. The submarine menace is one which is not lightly to be estimated. The campaign against England has been, although far from decisive, unpleasantly successful, and it is with great gladness that we learn of the active co-operation of a United States squadron in endeavoring to suppress it; but no good is done by premature announcements regarding the great things which Yankee ingenuity is about to do in the way of suppressing the submarines. We have abiding confidence, born of long experience, in the resourcefulness of the American inventor. In this case, however, he has set before him for quick solution by far the most serious task that has ever confronted the engineering profession. The public looks blindly for help in some

mysterious way from electrical devices of one kind or another. Electricity is still a name with which to conjure, so that the man in the street will swallow, hook, bait and sinker, almost anything that is thrown out to him in the way of an electrical promise.

Now, it is only fair to American engineers to state that a number of devices tending to the suppression of submarines have been suggested, investigated and tried. Some of them are regarded as very promising, well worth prompt experimentation on a considerable scale. Others give little hope of success, and while not fit for utter abandonment, cannot be considered as likely to relieve the situation. This much is certain, that whoever shall possess a thoroughly effective method of fighting submarines will be the last man in the United States to talk about it, for obvious patriotic reasons. People who bleat in the newspapers about what is going to happen when certain devices are adopted are simply playing into the hands of the enemy, the essence of success in all things being that absolute secrecy which leaves the foe without even a hint of impending fate or any knowledge of why submarines do not return save such as may be vouchsafed to him at the end of the war. Those who feel themselves near to the solution of the tremendous problem before us have it as their first duty to keep quiet and to keep their friends quiet lest knowledge of the danger suggest the cure. And, further, any one in an official position who babbles concerning such a matter should find his way to a federal prison by the shortest possible route. The less said the more will be accomplished, and nothing but evil can come of publicity regarding either methods or results. The public has a right to know in general whether things are being successfully done. It has no right to inquire into particulars information regarding which may save some submarine pirate from its doom.

Thompson Memorial Library

A PERMANENT memorial to the late Prof. S. P. Thompson is to be maintained, open to the public, in London by the purchase of his library and by adding it as an annex to the Institution's library on the Thames Embankment. Professor Thompson was a lover and collector of books. His electrical library is a rare and valuable collection. A committee of fifteen prominent scientists and engineers in England has been appointed to carry out the plan of raising a fund of $20,000 for the purchase of the Thompson library and of presenting it to the Institution.

Invitations for subscriptions have already been issued to the members of the Institution of Electrical Engineers in Great Britain. The committee felt, however, that since Dr. Thompson had many students, friends and admirers in America, it would only be courteous to open the subscription lists to electrical workers in America. The American Institute of Electrical Engineers has therefore issued a notice to its membership, inviting subscriptions to the Thompson memorial fund. We commend the movement as worthy of the support of American electrical engineers and bespeak for it a liberal financial response in this country.

The Modern Factory-Lighting Field

PROF. C. E. CLEWELL presents in this issue the first of a series of articles on the broad and important field of industrial lighting. At a time like the present, when the national crisis makes it necessary to rush the manufacture of supplies, many factories will find themselves in a condition of stress from the pressure which will most certainly be exerted to assure the completion of orders within specified dates.

Two channels are open for meeting this emergency. One of these, and probably that most commonly to be adopted, will be extending the hours of work to include the entire twenty-four-hour period of each day. The other will result in additional buildings for taking care of the abnormal demand for quick production. In both cases artificial lighting will play no inconsiderable part in the rate at which the work can be accomplished from day to day.

It is unusually timely, therefore, to present such a factory-lighting series, which can thus prove helpful not only in those cases where new lighting is to be installed or where improvements are under way in line with more or less normal conditions, but also to a great extent in rendering assistance at a time of acute national difficulties with the abnormal conditions they impose on many of the American industries.

One of the most surprising things to observe in this comprehensive treatment of the field of lighting is the very remarkable development which has taken place in the way such problems are looked upon both by factory owners and managers and by those more especially concerned with the engineering details of such work. It is little short of phenomenal to consider that prior to 1906 and 1907 the thought of using a metal-filament lamp for the general illumination of factory spaces was not only an unthought-of proposition but likewise one impossible of attainment. To-day the tungsten lamp is to be found on every hand for industrial lighting, and its peculiar flexibility of size in comparison with other types makes it an ideal unit for such work.

However, there are on the market to-day other important types of lamps which also have peculiar advantages for various factory purposes. For example, the mercury-vapor and quartz lamps have been adopted for wide and most successful applications in some of the largest installations on record. Improved types of arc lamps and special units such as the floodlighting lamps and the Moore tube color-matching lamp have their own particular uses. The aim of this series of articles is to explain the advantages of good lighting as a vital and tangible part of the propaganda of efficient management, and to outline the types of lamps now available, with an impartial and forceful discussion of where and how each may be used in representative classes of industrial service.

While new types of lamps have increased greatly the

possibilities of improved factory lighting, the owner or manager of an industry must first appreciate the economy, and we may add the necessity, of possessing lighting facilities of a high order before he is likely to realize their possibilities as an aid to his plant. Hence it is entirely logical to treat of these advantages in the preliminary article of such a series and later on to show how legislation must be depended upon to bring up the standards of lighting in those cases where managements lag behind the generally progressive tendencies of the times.

Taken as a whole, Professor Clewell will give in this series a most comprehensive and helpful treatment that will be of very material help to industries now preparing to improve lighting conditions for the fall and winter months. The series will also serve lamp manufacturers and central stations in furthering the use of more and better light.

Efficiency by Combination

WE HAVE preached many a sermon on the benefits to be derived from the skillful physical combination of generating plants, especially in the case of hydroelectric transmissions. One can hardly find a more useful text for a further homily than in the paper by J. A. Walls in our current issue. The time has come when extraordinary pains should be taken to make the most of hydroelectric resources and to save coal in every possible way. The transportation problems alone that are now before the country, to say nothing of the probable shortage of labor, are sufficient causes for investigating every possibility of fuel economy. At present the railroads are in a hopeless muddle for reasons too complicated to discuss here, even were such discussion within our province; but the obvious fact is that the more promptly steps can be taken to lessen the call for coal and the burden of coal transportation the better it will be for the country.

The application of this principle to electrical affairs needs little comment. The more power generated in big and economical stations and distributed as energy the less draft upon our coal supply and our means of carrying it. The special example considered by Mr. Walls is of a somewhat unusual character, inasmuch as the two cities concerned in the physical combination of utilities are at two ends of a fairly long transmission line with the power station between them, Lancaster, Pa., and Baltimore, Md., being the termini considered. The lighting and traction companies in both cities are parties to the arrangement for their mutual advantage. The chief load is carried by the water-power development on the Susquehanna River. By tying the plants together advantage could be taken of the diversity factor so as to lessen the total call for fuel and to enable the less efficient steam generating units of both plants to be shut down. By this conjoint scheme of working, the load factor of the hydraulic source of supply is kept above 90 per cent and a considerable improvement is made in the efficiency of the steam plants. The hydroelectric system gains in efficiency and the steam generation is accomplished with less waste of fuel and, what is equally important, less transportation of fuel.

The maximum gains were obtained only at the cost of considerable study of the exact load situation and adroit work in load dispatching so as to secure the highest efficiency. It is a fine example of the advantages of combined operation even of somewhat distant plants. It is easy to see how by extending the use of similar methods still greater gains could be made. Suppose, for example, that another plant taking power from the great Susquehanna station were well up in the coal fields, with possibility of relatively very cheap fuel, so cheap perhaps that under ordinary circumstances hydroelectric power would have but a small advantage; yet by a union of forces all would gain, the hydroelectric power would receive a still steadier load and hence would be operated at better average efficiency, and at times when steam had to be used power could be derived from cheap fuel in a highly efficient generating station, and wires instead of freight trains would accomplish the transference of the necessary energy. The long and short of the matter is that carrying energy in the form of fuel, which has at best a very low efficiency of utilization, is not an economical process and is particularly undesirable when, as now, the transportation facilities of the country are overstrained with the burdens of the hour. Now, if ever, is the time to make the most of the saving in fuel and men to be accomplished by electrical transmission.

The Coming Issues

SINCE there is every likelihood of the price of coal attaining higher levels, there is a possibility that oil engines will fill a greater niche than they ever have before in plants having poor load factors. To reduce operating expenses not only must more work be accomplished with less labor, but banking of boilers and other stand-by expenses must be eliminated or reduced. One article which will be presented in next week's issue will contain a discussion of the characteristics of and field for different types of oil engines. Another article in this issue will describe a method adopted by one large operating company for continuously indicating the condition of insulation on generators while they are operating. This subject should receive particular attention at this time, as the insulation must be watched carefully to prevent breakdown under the heavy overloads which will probably have to be carried because of increased industrial activity. The second installment of Professor Clewell's series on factory illumination will also be presented. It will deal with representative modern lamps, their fields of usefulness, and four types of industrial lighting. In the third issue of the month will be presented a discussion on the mutual inductance of parallel-axis reactors. This article will contain curves with which this factor can be readily determined without calculation. Another article will take up a method of determining the most economical distribution of transformers for a secondary system.

What Adequate Lighting Means to Industries

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

This article emphasizes the need for artificial light in summer as well as in winter months based on tests under actual service conditions, and points out some of the direct and indirect advantages of adequate light to the factory from the standpoint of increased production for the same labor and overhead cost, or of the same production with reduced labor and overhead. Other distinct advantages which are discussed include the effect of good light on accuracy in workmanship; the benefits which accompany reduced eyestrain as one of the elements in the physical fatigue problem; the beneficial reaction of cheerful surroundings, which is an important influence on operatives and which tends to increased order, neatness and sanitation and to greater care in the handling and operation of machinery and apparatus generally, also to more effective superintendence and management.

EFFICIENT factory management, it was pointed out recently in an editorial in a mechanical journal, requires that careful attention shall be given, first, to scientific time study, and second, to the gathering of data on the influence of such factors as shop lighting, heating, sanitation, ventilation, rest periods and surroundings upon production and upon the welfare of employees. This is an interesting proposition, because it divides successful factory management into two parts, one of which relates directly to production, while the other is concerned with more or less indirect influences on the employee, which in turn have a considerable effect on production.

Lighting as a Factor in Management

As one of these influences on successful factory management, lighting may be regarded first as a fundamental requirement for clear vision, and second, as a factor which contributes to the working efficiency as well as the comfort and contentment of every workman. As no chain is stronger than its weakest link, so with industrial workers—the eye, which is one of the most valuable of the senses, often fails with advancing age before the general physical strength gives out. Hence good light may properly be classed along with other helps in the conservation of the laboring classes, since it may be properly looked upon as an aid and a protection to eyesight, helping the workman to retain his standard of usefulness throughout the normal period of working years and to guard against failing vision.

Either consciously or unconsciously it is usually customary to associate activity with light, for without light, in one form or another, activity in a factory must cease. An adequate system of illumination is thus demanded from the standpoint of welfare as well as that of economy. The element of economy may be easily observed in any factory where no adequate provision is made for light, because of the noticeable lag in starting up the factory on dark mornings and in the slowing up of the work with approaching darkness toward the close of the day.

In marked contrast, the well-lighted factory, both directly and indirectly, promotes an increased output of better quality, tends to a better disposition among employees, reduces the liability to accidents and mistakes. All of these benefits are usually available with an expenditure equivalent to 1 or 2 per cent of the total production cost. The marked increase, recently, in attention to the subject of factory lighting has been due in no small measure to a realization, on the part of factory executives, of the influence of good light on workmanship.

The Engineering Point of View

Notwithstanding the importance of this higher appreciation of good lighting by factory managements, the engineering methods by which the proper results can be secured are, of course, equally important. The appearance of new electric lamps in sizes ranging from very small to very large units, and with remarkable increases in candlepower for given energy consumption, has done more than any other single item to advance the art of industrial lighting. For the proper application of these many new types, and because of the demand in the modern factory for lighting conditions which a few years ago would have been thought extravagant, engineering talent has become indispensable.

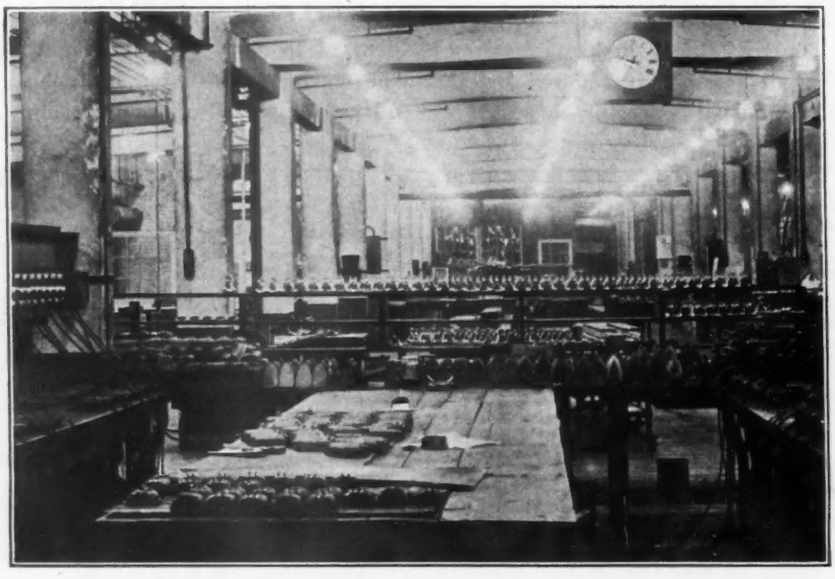


FIG. 1—SHOP ILLUMINATED TO PERMIT EFFECTIVE WORK THROUGHOUT ENTIRE DAY

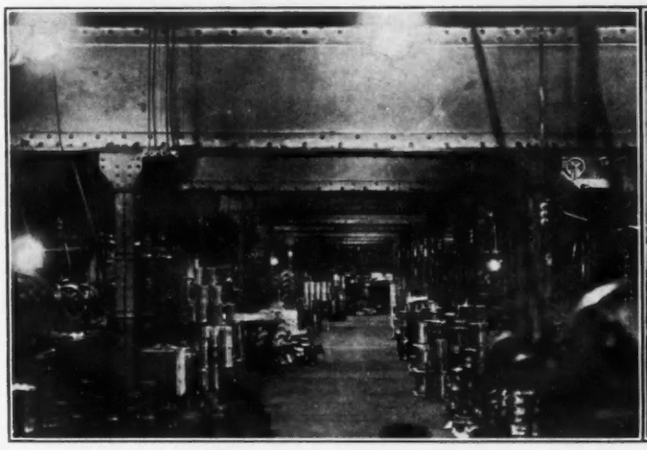
In many of the older factories it has been necessary to educate the operators to the many advantages of good light. Trial installations or reference to other successful installations have been necessary in some cases to convince factory owners that good light brings returns and is not merely a source of expense. Since the interest of the average factory

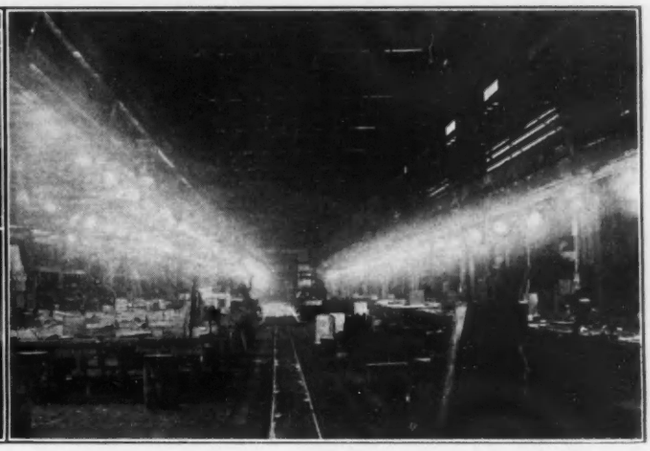
owner can so often be secured through arguments which affect the output of his plant, there is, perhaps, no better way of obtaining his attention than to recount briefly some of the experiences in an actual plant. In line with this suggestion a particular case will be discussed where a portion of the factory buildings had been relighted according to modern ideas of good illumination, and where efforts were successfully made to convince the management that another expenditure was a step of economy.

BRIEF DESCRIPTION OF AN ACTUAL CASE*

During a period of one and a half years the company spent about $50,000 on lamps and wiring for installing a new and improved lighting system in its plant. In some places more arc lamps were installed, in others mercury-vapor lamps were employed, and in still another large portion of the plant tungsten lamps were adopted for the first time.

The work, however, was only partially completed, and the persons who were directly connected with the lighting work desired to see the improved illumination extended throughout the entire plant so that all dark spaces would be eliminated. To do so it was necessary to convince the management that the economies already effected warranted the additional expenditure.





FIGS. 2 AND 3—MEZZANINE FLOOR CONVERTED INTO AN EFFECTIVE WORKING SPACE; SHOP MADE BRIGHT BY USING MODERN MEDIUM-SIZED LAMPS IN PLACE OF FLAME-CARBON ARC LAMPS

NATURE OF THE ADVANTAGES TO THE PLANT

Since too many other conditions were changing throughout the plant at the time useful figures could not be obtained from the auditor's office. Consequently persons in the factory were asked to observe the conditions with the new lighting and compare them with those formerly existing. Among the results† of this canvass the following may be mentioned: One manager stated that under the older dark conditions in two sections good men would not stay and the departments had to be run with inferior or with new men. With the new lighting good men were glad to stay at the work. In an entirely different part of the factory, where the work was of another kind, a superintendent noted the same general condition. In still another section an individual workman testified that under the old conditions he was greatly hindered in getting about, because he could not see where he was stepping (the section had practically no daylight facilities) and the presence of rough pieces of scrap iron on the floor hindered his movements in finding material and in getting around in the operation of his machine. Personal observation in this section, after the new lighting was installed, showed that the floor was kept cleaner and bits of iron were not allowed to accumulate on the floor. In other words, a greater interest was being taken to keep the place in a neat and sanitary condition because of the better lighting conditions.

The foreman in another section, where unusually fine work was performed, stated that on one occasion the men on the night shift had not been able to do any work for the last two or three hours of the night because the old arc lamps had been out of order. This was a case of a direct loss at a time when production was sufficiently urgent to make night work necessary.

One of the foremen in another section of the factory stated that with the old inadequate light it was not unusual on dark mornings for the men to lose considerable time. For example, from 7 to 9 o'clock in the morning they would not do more than an hour's work, and the same condition prevailed during the last two hours of the day. According to this statement, there was a loss of two hours per day, or one-fifth of the time, due to bad lighting on dark days.

An individual workman in another section made the statement that under the old lighting it was necessary when he wanted to read a scale to place his thumb at the point on the scale and then to walk 20 ft. or 25 ft. (6.1 m. to 7.6 m.) to the nearest lamp, to read it. While this is an extreme case, it shows how several minutes can be consumed in an operation which should require only a few seconds.

COMPARISON OF LIGHTING COSTS AND WAGES

To reduce the findings for this particular plant to a more tangible basis, it is interesting to outline the total costs of lighting for a given floor area in terms of the wages for the same floor space. To do this, consider a factory bay like that shown in Fig. 4. Here ten 60-watt tungsten lamps are mounted at the ceiling of a comparatively low factory section. The total floor area of this unit bay is 640 sq. ft. (59.5 sq. m.), a space which will easily accommodate five or even more workmen. The fact that a single bay of this kind will accommodate

*Based on a memorandum made at the time by the chairman of the engineering committee in charge of relighting the plant.

†The cases refer to actual statements made by factory managers, superintendents, foremen and individual workmen.

say ten or even fifteen workmen does not warrant the assumption of these higher numbers, since throughout a large factory the distribution of materials and machines will probably reduce the average workmen per bay to the lower number. By taking five men for this unit area a more conservative rating of the wages per unit of floor space is thus assumed.

Under the further assumption that these five men

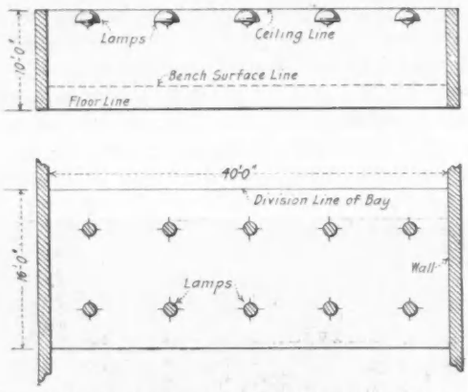


FIG. 4—ARRANGEMENT OF LAMPS FOR WHICH COSTS ARE SHOWN GRAPHICALLY IN FIG. 5

normally work eight hours per day, at the rate of $4 per day, the total wages per day per bay amount to $20. With overhead charges of 100 per cent for superintendence, etc., the total labor charge per day for the bay is $40, which is equivalent to $5 per hour, or to about 8 cents per minute.

From the lighting standpoint, it may be assumed that the ten lamps burn 2000 hours per annum, resulting in an energy consumption of 1200 kw.-hr. per annum. The maintenance charge, including renewals and lamp and reflector cleaning, may be taken at about 1 cent per kilowatt-hour, and the energy charge at say 2.5 cents per kilowatt-hour. Hence, the combined energy and maintenance charge per bay amounts to $42 per annum. Adding to this an interest charge of 6 per cent on the first cost of the installation (assumed as $50), the annual interest amounts to $3; and a de-

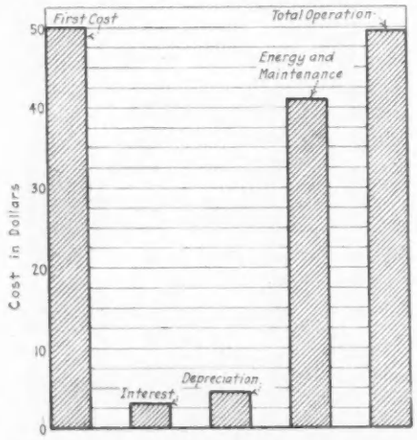


FIG. 5—FIRST COST AND ANNUAL OPERATION CHARGES FOR LAMPS

preciation charge of 12 per cent on the "non-renewable" value of the installation (taken as $37.50) amounts to $4.50, giving as a total for the operating cost of the lighting per bay per day a value of about 17 cents. These values are shown in a graphic form in Fig. 5.

From these relations the interesting deduction may be made that if the good lighting conditions make it possible for each workman to save as much as about two minutes per day of eight hours, the wages corresponding to this time will pay for the entire cost of lighting for the day. To appreciate what this means to the industries, it is only necessary to review the testimony of managers, superintendents, foremen and workmen as contained in the above account of the experiences in an actual plant, where losses of as much as several hours occurred under an old and inferior system. To find from a canvass of a plant, poorly furnished with light, that losses of an order of magnitude of thirty, sixty or even 120 minutes are occurring per day, when a total expenditure equivalent to the wages for two or three minutes per day will eliminate most if not all of these losses, can well form the basis for the most telling arguments in favor of necessary improvements.

Summer and Winter Requirements Contrasted

During the summer months, with the long days, there is a natural tendency to look upon illumination rather as a winter requirement and as a portion of the factory equipment attention to which, if improvements are needed, can be postponed until the shorter days of

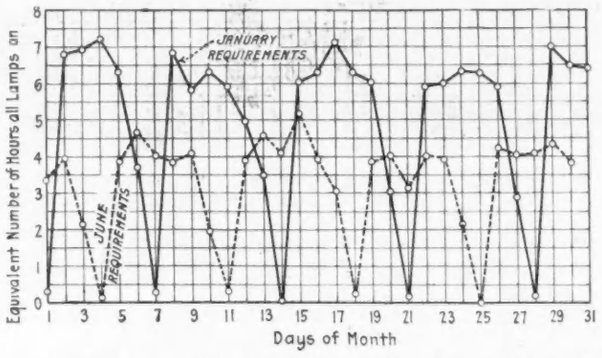


FIG. 6—NUMBER OF HOURS PER DAY DURING WHICH ALL LAMPS IN FACTORY SECTION WERE IN USE IN JANUARY AND JUNE

the fall and winter months. It is quite possible, therefore, that the persons responsible for making the investment may often put off the expenditure for illumination equipment to avoid the expense until the need is felt.

The writer has felt for a long time that there is considerable fallacy in the conclusion that artificial lighting is distinctly a winter requirement in the industries, and therefore suggested that tests be conducted over a sufficiently long time interval in a location where natural lighting facilities were good to secure some tangible information on this subject. Fig. 6 shows graphically the results of the test in a building one section of which is shown in Fig. 1. This factory has a number of floors, each of which is about 400 ft. (121.9 m.) long and 70 ft. (21.3 m.) wide, with a ceiling height of nearly 14 ft. (4.3 m.). Spacious windows extend along the two sides of the building and afford fairly abundant natural light to both side bays, and also normally, but in a lesser degree, to the central bays.

Occasionally some night work was conducted in certain parts of the various floors as special circumstances demanded, but the lighting requirements for this may be assumed to be fairly spread out because of the

length of time over which the observations were made. By noting the total watt-hours consumed in a given section and dividing this value each day by the total watts represented by all of the lamps installed in the section, a value results which may be taken as the equivalent number of hours during which all the lamps were in service. During January (taking only five full working days, that is, by eliminating Saturdays as half days, and also Sundays) the average is seen to be close to six and one-half hours per day, while in June it is close to four hours per day. These curves illustrate in a rather striking manner that the summer requirements may be as much as two-thirds of the winter requirements. Thus, in a case like this, good light is almost as important during the month of June as during January, even with the latter's shorter days.

The summer requirements were governed partly by fog and cloudy conditions during early mornings and late afternoons, also by generally cloudy conditions throughout the days, and by overtime work. Owing to the variables which enter, it is not presumed that these curves are generally applicable. They do show, however, the conditions in one factory where the need for artificial light was so poorly appreciated at the time the building was constructed that practically no artificial lighting was provided until long after the building had been occupied and used for manufacturing purposes.

Even with a considerable use of artificial lighting during the summer months, the summer requirements are less than those of the winter months. Hence persons in charge of the lighting division of a plant should consider the wisdom of conducting preparations during the longer days of the summer, when improvements are contemplated in an inadequately lighted factory. This is, of course, all the more desirable in factories where a wiring force is a part of the maintenance division of the plant. In view of the fact that the work of the wiremen and maintenance men will usually be heavier during the winter when the requirements for repairs and general upkeep of the lighting equipment is greatest, there is even more reason to undertake new work during the summer and early fall. It should also be noted that during the summer months, because of the reduced number of hours when the lamps are turned on, a change from an old to a new lighting system may be effected with the least disturbance to the regular employees through probable irregularities in the illumination service while wiremen are at work.

The foregoing notes have attempted to answer the general question of what adequate lighting means to the industries. From many standpoints it would be more desirable to be able to say definitely that good light will yield a return of so and so many per cent on the initial investment. Many efforts have been made to answer the question in this way; in some cases plans are contemplated for making the necessary investigations under actual factory conditions, so as to attempt to secure just such an answer. At the present time, because of the limitations of the available data and the absence of more complete information, the method adopted in this article for the treatment of this subject seems the only feasible plan, and it has the compensating feature that, when properly applied, arguments of the kind discussed may be used to considerable advantage, even with their tendency toward somewhat general rather than specific data.

PROTECTIVE EQUIPMENT

Arrangement of Spirally Wound Conductors Which Serve as Varying-Capacity Condensers to Absorb Transient Impulse Energy

It is now practically established that a lightning arrester should absorb the energy received rather than reflect line transients to be most effective. In an ingenious arrangement (patent No. 1,217,453), assigned by Ray P. Jackson of Edgewood, Pa., to the Westinghouse Electric & Manufacturing Company, a form of choke coil is proposed that has practical unity power factor for ordinary commercial frequencies, but which provides resistance, inductance and condensance for high-frequency transients. A relatively wide copper strap wound in the form of a spiral constitutes the current-carrying portion of the protective device. Between adjacent layers or convolutions of this winding are inserted layers of insulating material having high specific inductive capacity. The insulation may be made from paper or cloth impregnated with a suitable insulating compound or varnish, such as bakelite. Layers of a material such as asbestos cloth having a relatively low specific electrical conductivity with respect to that of the paper or cloth layers are similarly placed between the adjacent convolutions.

When high-frequency disturbances of short wave length are impressed upon the device, small segments of the conductor layers act as condenser plates, the effect being about the same as if condensers were connected in series around the coil. As the frequency of the disturbances decreases, larger segments of the coil act as condenser plates. As a consequence the capacity of the protecting device is automatically varied in accordance with the frequencies of the impressed impulses. The charging current supplied to these condensers must pass through the high-resistance layers, which absorb the energy of the charges and dissipate it as heat.

VIBRATING-TYPE RECTIFIER

Consists in the Employment of Contact Members Having Relatively Large Contact Surfaces

Thomas A. Edison of Llewellyn Park, West Orange, N. J., discloses in patent No. 1,221,981 a new principle for use in conjunction with mechanical alternating-current rectifiers. The usefulness of rectifiers of the mechanical type, as hitherto constructed, has been materially limited by the small current-carrying capacity of the apparatus and by their inability to operate successfully on any but low-voltage circuits, because of sparking and sticking of the contacts.

In brief, the rectifier consists of a number of vibrating armatures which carry contacts that are connected in series or series parallel. The series connection affords a plurality of breaks in series in a single unit, whereby sparking is reduced and the apparatus is rendered capable of rectifying currents of relatively high voltage. The series-parallel connection combines the advantages of the series and parallel connections.

The contact members have relatively large contact surfaces, one or both of each pair of co-operating contact members being preferably of carbon. By the use of contacts of this character the current-carrying capacity of each rectifying unit is increased, sticking of contacts is prevented, and sparking is reduced.

Power for Manufacturing in War Time

How Additional Power Has Been Made Available for Industrial Purposes by Several Utility Companies Interconnecting Their Systems, Thus Permitting Maximum and Most Economical Use of Combined Equipment

BY J. A. WALLS

Vice-President and Chief Engineer Pennsylvania Water & Power Company

BECAUSE of the great demand for power for manufacturing purposes caused by the war, it has been hard to procure generating equipment and coal for power generation; consequently manufacturers, large and small, have been turning to the central stations to carry their loads. In other words, the manufacturer has thrown the burden of securing electrical generating equipment and coal for generation upon the central station, where it properly belongs, freeing his energies for application to his own manufacturing affairs.

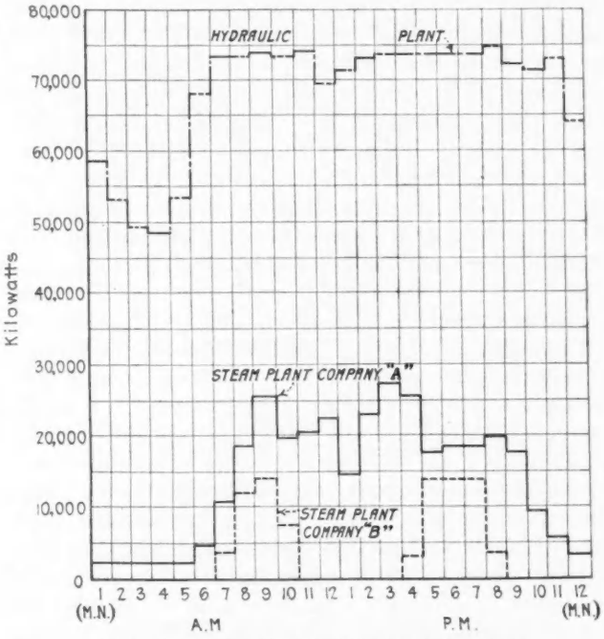
Central stations are thus confronted with the difficulty of getting deliveries of generating equipment, and also face higher prices for labor, material and coal. As central stations can use larger units than the individual plants they serve, there is a benefit to the country in the present war situation, because electrical apparatus manufacturers are relieved from building the host of small generating units otherwise needed for the individual manufacturing plants. Furthermore, the wholesale generation of power by central stations permits a saving—of present great importance to the nation—in the items of labor, material and coal, as against what is required for isolated-plant operation.

The more efficient use of the available supply of coal, labor and manufacturing capacity permitted by concentrating power generation in large efficient central stations makes it appear that still further benefits might be gained by combined operation of existing generating plants now under the control of separate corporations. Such operation would apply to plants situated in the same or adjacent cities, or where they would be able to exchange power over a connecting transmission system. The growing tendency in peace times for street railway systems to purchase power for their operation from central stations is one which might well be carried out more extensively under the present war conditions.

An example of the benefits derived from such operation is afforded by the public service companies of Baltimore, Md., and Lancaster, Pa., the street railways, lighting and power systems of the two cities having been tied together through the transmission system of a hydroelectric plant. With this arrangement it has been possible to work out a method of operating the available generating equipment of four public utilities so as to obtain a higher combined efficiency. Since the time of peak load of one utility does not coincide with the time of peak load of the others, the rating of generating equipment which will suffice to carry the combined load is less than if each of the utilities were to carry its own load with its own generating equipment.

Instead of one public utility using for its own load whatever efficient or inefficient equipment it happens to have available, it is possible, owing to the tying together of the generating plants, to shut down the most inefficient units of each plant and to run the large-capacity, high-efficiency units for the major portion of each day. The units with lower efficiency may be called into service principally during peak periods or during low-water conditions, and the most inefficient units of all may be kept idle or brought into service only during extreme conditions of seasonal peak, extreme low water or breakdown of other generating equipment.

Despite the unusually heavy load suddenly thrown upon these public service utilities, there is left available for off-peak generation a certain amount of relatively low-efficiency apparatus which can be called upon for generation in case of special demands by the government for power to manufacture war munitions. This equipment will be used regardless of the higher cost entailed by operating the less efficient power-generating equipment.



LOAD DISTRIBUTION ON COMBINED SYSTEM

The load carried by the hydraulic plant is well above 90 per cent load factor. The largest part of the steam generation is carried by the most efficient equipment operated by company A. Instead of using the remaining less efficient equipment to carry the two dotted peak loads, they are carried by the most efficient turbines of public utility B.

By carrying the bulk of the load with water power the public utilities of Baltimore and Lancaster were relieved to that extent of their coal difficulties, and by tying the plants into one system it was possible to take advantage of the diversity factor. Another advantage secured by the arrangement is that it is possible to put the bulk of the steam generation upon the most efficient steam-generating apparatus, and the old and inefficient equipment is called upon for less generation than would have been the case if the systems were not being operated for maximum combined efficiency. This makes for further saving in coal requirements for these localities.

In addition, breakdowns in any one utility are less apt to cause disastrous results in view of the possibility of obtaining assistance from unused equipment in the other utilities. In other words, relatively more reserve capacity is available than when the individual plants are operated separately.

The problem of obtaining the maximum combined operating efficiency is not a simple one. There were involved the difficulties of load dispatching, the necessity of considerable engineering investigation and the need of tests to ascertain costs for different operating conditions in the various steam plants.

The complete working out of this problem to obtain maximum efficiency is almost impossible in the face of rigid power contracts. However, the companies involved in this particular transmission system thoroughly appreciated the benefits to be derived from co-operation along the lines mentioned and allowed the power contracts to be so interpreted or modified as to make it possible to secure many advantages which otherwise would have been lost to all concerned in the general industrial situation in Baltimore and Lancaster. In view of the great demands made upon electrical manufacturers and transportation systems, it seems that this subject deserves attention in other cities favorably situated.

SELLING SECURITIES TO EMPLOYEES AND CUSTOMERS

The Opinions and Experiences of a Central Station Manager Who Succeeded in Raising Capital from His Community of 16,000 Inhabitants

Now that the United States is one of the belligerents it may be increasingly difficult, particularly for the smaller companies, to float bond issues. While there is apparently sufficient money in the country, there is still a feeling that money should not be tied up for too long a time, that it should be in as liquid a state as can reasonably be expected. In this connection, therefore, the experiences of a company in a small town in Ohio in distributing its securities among consumers and employees are not only interesting but may prove of value to other companies in the near future.

As explained by T. O. Kennedy, vice-president and general manager of the Massillon Electric & Gas Company, in a paper read before the commercial committee of the Ohio Electric Light Association recently, the necessity of raising money was forced upon the property in Massillon, a city of 16,000 inhabitants, in August, 1914, and some way had to be found for accomplishing it.

The company was confronted first with the problem of what form of security to offer, with regard both as to what forms were available and as to which would best appeal to its consumers, and became convinced that, in its own situation and under the particular conditions then obtaining, a purely local security could be sold more easily than an issue of the holding company and that it would be more advantageous for many reasons to offer a security of its own.

There was available at that time an issue of first mortgage 5 per cent gold bonds, but in August, 1914, investors were extremely averse to tying up their money for any great length of time. Consequently it was decided to issue collateral trust notes with these bonds as security. The local nature of the issue was emphasized by having a local bank act as trustee, and the notes were made for one year from date of issue. The interest rate was fixed at 7 per cent, owing to the tightness of money at that time and to the fact that competition for capital was strong in Massillon.

In connection with the marketing of the note issue Mr. Kennedy said:

"Before announcing our offering of notes we entered upon a publicity campaign by securing as many newspaper stories as possible describing our new power contracts, our proposed construction work, etc. In one interview stress was laid upon the fact that we intended to offer our securities first to our employees and consumers before accepting offers from underwriting brokers.

"When the notes were ready for sale we used a small amount of space in the daily newspapers and in a local trades labor weekly. These advertisements were patterned after the customary brokers' announcements and were not run long enough to give the idea that any difficulty was being experienced in selling the securities. We did not feel that this form of advertising did much good, and on a later issue we wrote our copy in a more popular form that we believe appealed more strongly to the people we were trying to reach.

"No letters were sent out except to 'prospects' who had been definitely located. In the later campaign, however, we sent a carefully written letter to each of our consumers inclosing a subscription blank. We secured very good results from these letters and feel that from the standpoint of public policy the letters were worth all they cost, even if no subscriptions had been received as a direct result.

"Our next step was the arrangement of a campaign of personal solicitation. Four members of the local organization were drilled in good selling talks and were offered a small commission for all sales made. One member of our board of directors, a local attorney, was also offered the same commission.

"The first selling efforts were made among our own employees, partly for practice, but mainly in order that every employee should fully understand the proposition so as to be able to answer the questions of other 'prospects.'

"All of the professional men in the city were solicited, and we not only made sales to several but secured good tips from ministers, doctors, dentists and lawyers. Insurance men were also a source of good information concerning people who had money to invest.

"A special effort was made to secure the funds of lodges and fraternal organizations. This short-time security appealed to these 'prospects,' and we had very good success. In some instances we dealt only with the finance committees, but in others it was necessary to submit the proposition to the entire organization at a regular meeting. We feel that this was also worth a great deal to us from a public policy standpoint.

"As the notes were also being offered by brokers in nearby cities, we co-operated with them fully, especially when a broker had regular clients residing in our community.

"For the purpose of locating laboring men with incomes sufficient to enable them to invest, we secured the payrolls of large manufacturers in our town."

Helping the Financial Mobilization

Electrical Companies, Pressed by Unprecedented Demands for Energy Under Conditions Which Make High Standards in Service Costly, Must Maintain Facilities

IN HIS statement to the ELECTRICAL WORLD, published in last week's issue, F. A. Vanderlip, president of the National City Bank of New York, said:

"With industrial activity incident to the expenditure of large sums by the government, factories will be unusually busy and laborers will all be busy and working at high wages. This should mean a large sale of energy for electric light and power."

Then, in adding a caution against any expenditure that is unnecessary or that can just as well be postponed, Mr. Vanderlip said:

"We are giving the government $7,000,000 of purchasing power; our business is war; we cannot continue to have the same purchasing power ourselves while the government is exercising this purchasing power."

For the industry at large this means that in the opinion of the foremost financial authority in the country the companies may expect:

(1) A continuation of growth in business to the extent that their facilities of plant and fuel supply will permit.

(2) Subordination of their financial needs to the financial program of the government.

Gross Earnings Continue Large

The ELECTRICAL WORLD'S regular monthly compilation of central station earnings and output, published elsewhere in this issue, shows that business is continuing to maintain large gains over the corresponding period of the previous year. As compared with the previous year the March returns indicate gains of 15 per cent in gross revenue and 25 per cent in the output of energy. Neither the statistics, therefore, nor the prospects clearly in sight indicate anything but that business will be maintained at top notch.

The problem before the central stations is to keep organization and equipment at the highest point of efficiency, to insure the utmost conservation in the production, distribution and use of energy. Certainly all of the efforts of companies will be directed toward economical production and distribution. In the effort to secure economy in the use of energy, however, public co-operation, perhaps even legislative or military action by the authorities, will be necessary. If for military reasons it is advisable that power be withheld from one or more classes of users to be applied to other industries it will be the plain duty of the constituted authorities and the companies to follow whatever course meets the national need. Technically such action might involve discrimination under regulatory laws; actually the companies would be lacking in the first characteristic of patriotism if their resources were not subject to the national call before any other. If the co-operation of the authorities is desirable to keep every step of this character within the strict bounds of legality the commissions generally will, it is believed, act without delay.

In plans for careful conservation in the use of energy there is no expectation that volume of gross output will be on anything but an ascending scale.

The other point raised by Mr. Vanderlip in his statement is that in effect the companies cannot finance while the government is making so heavy a call upon the investment resources of the country. This is fully realized by company executives. It is fair to say that the companies have not been caught unfinanced, widely extended in commitments to capital expenditures or with large outstanding short-time bank loans. Pretty generally they have financed their requirements to or including the year 1917. The great demand for securities in 1916 enabled them to provide for their capital needs.

What they face now, however, is a demand for more and more energy for absolutely imperative industries at a critical juncture when it is conceded that corporate financing must and should wait until the national treasury says that it has enough. They willingly wait not only until the avenues of finance are open again, but they also withhold their needs in materials and supplies until the government's prior needs are met.

Such a policy, although accepted patriotically, requires the most careful planning for the future. By the economics of the industry companies are prevented from continuing to expand at the rate of the last two years without an expansion in physical plant corresponding roughly to the increased volume of business. It takes $50,000 to $100,000 of investment to make $10,000 of gross earnings. Add 15 per cent to gross earnings of the figure stated and it takes, say, roughly, $7,500 to $15,000 of investment to provide for it. Even if the company, by superior operating efficiency or by overloading plant, is able for a time to take care of larger volume of business without larger investment, the moment of capital expenditure is only deferred; it must be made sooner or later.

Until the time when financing is again possible on the largest scale, it is to be expected that operating resources and ingenuity will be strained to the utmost. "Daylight saving" may be adopted to promote conservation. Another step which is suggested is that factories be encouraged to dismiss operatives at irregular hours so as to lessen the peak-load power requirement of electric railways.

Two of the matters which are receiving urgent consideration at present as part of the entire large question involved are coal cost and supply and other costs. Both of these operate heavily against economical operation at this time and no certain relief is in sight.

In the final analysis it is evident that the companies cannot permanently both increase business and refrain from capital expansion. Since larger volume of business is clearly inevitable the alternative which will be adopted is that of scrutinizing every capital expenditure so that each dollar shall be put where it will do the most good.

Mr. Vanderlip also made the general statement that "the 'cost of living' to corporations will go up as it

does for individuals, but public service corporations cannot raise their rates as their costs advance." Without any effort to interpret the views of Mr. Vanderlip, it will be recognized that while increases in rates by electrical utilities have not been commensurate with the abnormal increase in cost, some advances in power rates have been made which tend to offset in certain properties the heavier cost of coal, etc. Such advances have been made after the extent of the burden caused by higher operating costs has been demonstrated clearly.

PRICES OF SECURITIES

Prices of securities of electrical companies do not give a definite clew to the future to the seeker for information of prophecy value. Comparatively few of the securities of electric central station companies are listed on the stock exchanges. Those which are so listed, of course, suffered with other securities in the widespread decline which followed the announcement of war but has now apparently been arrested by the growth of a better sentiment and a better understanding of the tremendous effect of the government's great buying program.

Many conflicting influences in the markets, such as the overwhelming preponderance of speculation in war and metal specialties, the shadow which hangs over the steam railroad situation and the heavy financial requirements of the government, make it especially difficult to appraise the position of good public utility securities.

Such securities should be and in ordinary times are less subject to violent fluctuation than the majority of active stocks. The business on which they are based is more stable, and its growth at a fair rate from year to year without interruption is to be expected under all but extremely abnormal conditions. So many of the operating electric central station properties, however, are connected with gas or other utilities or are controlled by holding companies that it is difficult to compile accurate comparative statistics.

COMPARISON OF CENTRAL STATION AND OTHER STOCKS

	1917 High	1917 Low	1916 High	1916 Low
WHOLLY OR PARTLY ELECTRICAL PROPERTIES				
Columbia Gas & Electric Co., Cincinnati	*47⅞	34⅛	53⅞	30¼
Commonwealth Edison Co., Chicago.	142⅞	‡120¼	147	139½
Consolidated Gas Co., New York...	134⅝	104⅜	144¾	129¾
Consol. Gas, E. L. & P. Co., Baltimore	127	109½	130½	107
Edison Electric Ill. Co., Boston.....	226	183	250	225
Montana Power Co. com.....	109¼	93½	114⅞	68¼
Montana Power Co. pfd.....	117½	114	117¼	109
North American Co.....	72⅜	61	75⅞	65½
Pacific G. & E. Co., San Francisco...	†68¾	55¾	67	56
Philadelphia Electric Co. ($25 par).	34⅜	29½	34½	27
United Gas Imp. Co. ($50 par).....	91½	‡76¾	93½	86
OTHER UTILITIES				
American Tel. & Tel. Co.....	128½	116¼	134½	123⅛
Boston Elevated Railway.....	79	65½	88½	65½
Brooklyn Rapid Transit Co.....	82	54	88⅞	81
Brooklyn Union Gas Co.....	129	116½	133½	126
Chicago Railways, Series I.....	72	69	80	70
Chicago Railways, Series II.....	25	12	27½	13
Interborough Consolidated Corporation, New York, com.....	17⅛	8¼	21⅛	15½
Interborough Consolidated Corporation, New York, pfd.....	72¼	50¾	77½	69
Mackay Companies com.....	89¾	82¼	91	78
Mackay Companies pfd.....	67½	64	68¾	64⅞
Massachusetts Electric Cos. com....	5½	3	8¾	4½
Massachusetts Electric Cos. pfd.....	27½	20	44	26
Massachusetts Gas Companies com..	100½	87	100¾	79
People's Gas Lt. & Coke Co., Chicago	106¼	70⅞	118	100⅛
Third Avenue Railway, New York...	48¾	17⅛	68½	48
Western Union Telegraph Co.....	99¾	90¾	105½	87
STEAM RAILROADS				
Atchison, Topeka & Santa Fe com...	107½	98½	108⅞	100¼
Baltimore & Ohio com.....	85	67⅞	96	81½
Chicago, Milwaukee & St. Paul com..	92	69⅞	102½	89
Chicago & Northwestern com.....	124¼	108¼	134⅞	123
Great Northern	118¼	103⅞	127½	115
Illinois Central	106⅜	100	109⅞	99¾
Louisville & Nashville.....	133¾	119	140	121⅛
New York Central.....	103⅝	86	114¼	100¼
Norfolk & Western.....	138⅝	116½	147⅛	114
Pennsylvania	57⅜	51⅜	60	55
Southern Pacific	98½	88¾	104¼	94¼
Union Pacific	149⅛	128⅞	153⅜	129¾

*New York Stock Exchange quotation. †Chicago Stock Exchange quotation. ‡After new allotments of stock at par pro rata.

COMPARATIVE STATISTICS

It is thought best by the ELECTRICAL WORLD, however, to present such statistics as are available to compare the recent fluctuations in central station securities with those of other properties. The intent is to confine the list so far as possible to stocks having a free and active market on exchanges, and especially to omit any properties affected in large degree by war orders.

Even with this explanation it is necessary to modify the presentation by the statement that in many cases some development of a local or special nature has had an effect upon quotations. Steam railroad stocks are at a very low level compared with the levels of recent years. The Montana Power Company has been increasing its dividend return. The Commonwealth Edison Company of Chicago gave stockholders the right to subscribe to a new issue; and in addition the long-continued franchise and rate controversy between the city of Chicago and the People's Gas Light & Coke Company, leading to a reduction in the dividend rate of that company, has had a sympathetic effect upon securities of all Chicago utilities. The stock of the Edison Electric Illuminating Company of Boston has been affected by the financial exigency of the Boston Elevated Railway.

Subject to these qualifying considerations, the accompanying statement may be accepted as indicating that the listed stocks of electric central station companies have been substantially as stable, and generally on a higher level, when compared with recent years, than the securities of the other companies shown.

PRICES LOWERED TOO MUCH, SAYS INSULL

After the recent flurry in public utility stocks Samuel Insull, president Commonwealth Edison Company of Chicago, expressed the belief that the drop was unwarranted.

"Gross receipts," said he, "are unprecedented, and while expenses are extremely high, they are by no means of an extremity to have warranted the depreciation in the certificates of the general run of utilities companies.

"Such a decline would suggest a reduction of dividends, a suggestion which is without warrant so far as the companies with which I am associated are concerned. To instance the Commonwealth Edison Company, I am certain that the 8 per cent dividend is not imperiled.

"Relatively, the same assurance may be extended to the other properties under my charge. It is well to remember at present (when the public is more or less disquieted by the lowering quotations on the stock exchange) that, in addition to the seasonal lower cost of operation which necessarily exists because of the difference in the demand for fuel between summer and winter, other savings are possible."

"The bourse pendulum, as it relates to electric and gas utilities stocks, has swung too far in the adverse direction. I speak, of course, from the viewpoint of intrinsic property value and of earning power."

"Give Us a Chance to Make Good"

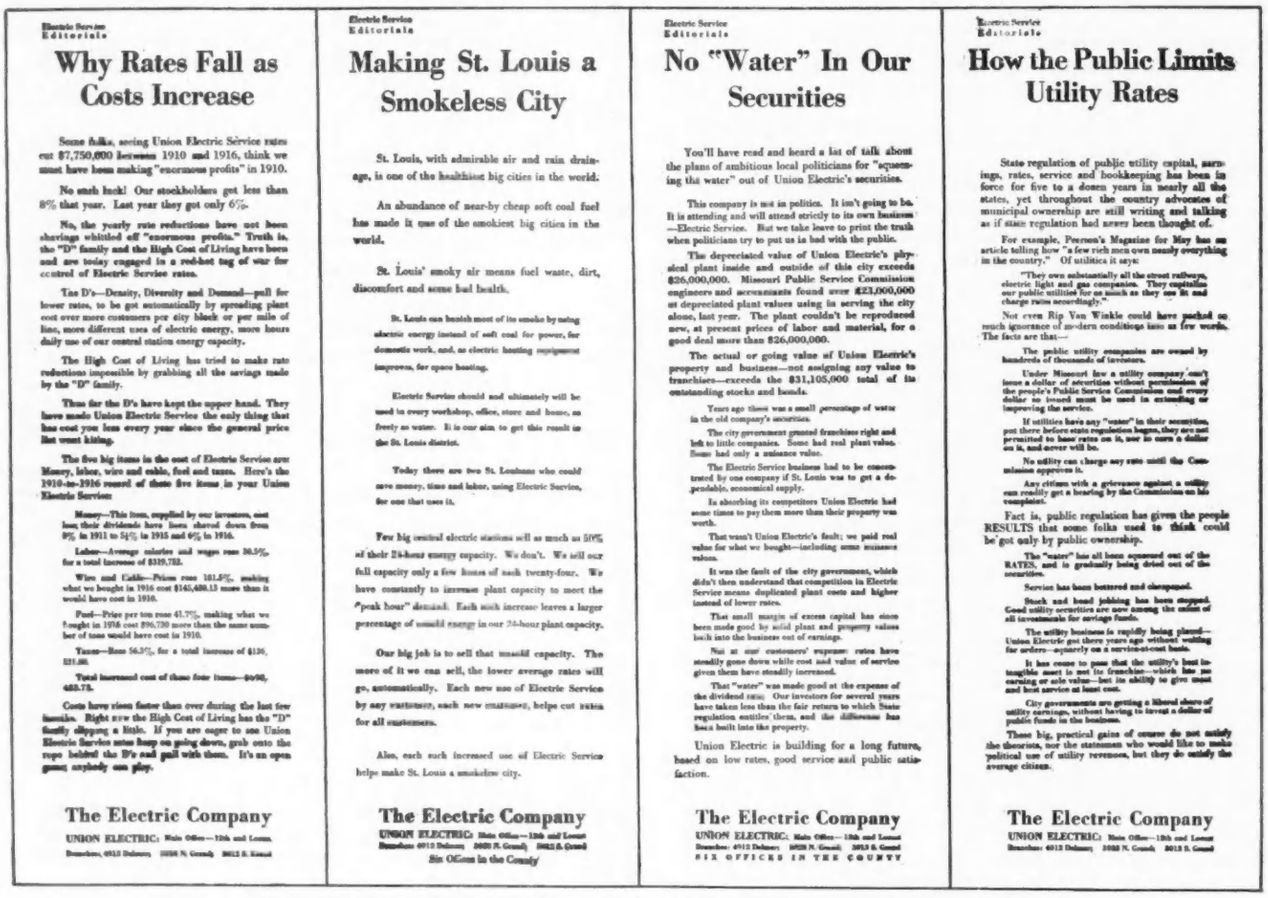
Union Electric Light & Power Company of St. Louis Conducts a Successful Newspaper Advertising Campaign Dealing with Service, Finances, Rates and Merchandising

THE Union Electric Light & Power Company of St. Louis has published in local newspapers a series of advertisements dealing with its service, financial position, rates and merchandising features.

As a culminating feature the most recent advertisements offered to its customers the new issue of preferred stock of the company. Without intervention of bankers or direct solicitation, but solely as a result of the advertising, the stock was disposed of in a week.

Several of the advertisements went into the detail of the history of the contract with the Mississippi River Power Company for power. "Perfectly Good Humor, No Hitting Back, Just the Facts," said the company. Succeeding advertisements presented facts showing that the contract was an industrial asset for St. Louis.

Repair facilities, lamp renewals, why rates went down as volume of business increased, equalization of residence rates and the large taxes were notable features.



Electric Service Editorials

Why Rates Fall as Costs Increase

Some folks, seeing Union Electric Service rates cut $7,750,000 between 1910 and 1916, think we must have been making "enormous profits" in 1910.

No such luck! Our stockholders got less than 8% that year. Last year they got only 6%.

No, the yearly rate reductions have not been shavings whittled off "enormous profits." Truth is, the "D" family and the High Cost of Living have been and are today engaged in a red-hot tug of war for control of Electric Service rates.

The D's—Density, Diversity and Demand—pull for lower rates, to be got automatically by spreading plant cost over more customers per city block or per mile of line, more different uses of electric energy, more hours daily use of our central station energy capacity.

The High Cost of Living has tried to make rate reductions impossible by grabbing all the savings made by the "D" family.

Thus far the D's have kept the upper hand. They have made Union Electric Service the only thing that has cost you less every year since the general price list went hiking.

The five big items in the cost of Electric Service are Money, labor, wire and cable, fuel and taxes. Here's the 1910-to-1916 record of these five items in your Union Electric Service:

Money—This item, supplied by our investors, cost less, their dividends have been shaved down from 8% in 1911 to 54% in 1915 and 6% in 1916.

Labor—Average salaries and wages rose 30.5%, for a total increase of $339,782.

Wire and Cable—Prices rose 101.5%, making what we bought in 1916 cost $145,480.13 more than it would have cost in 1910.

Fuel—Price per ton rose 41.7%, making what we bought in 1916 cost $96,730 more than the same number of tons would have cost in 1910.

Taxes—Rose 56.3%, for a total increase of $130,121.60.

Total increased cost of these four items—$676,982,475.73.

Costs have risen faster than ever during the last few months. Right now the High Cost of Living has the "D" family slipping a little. If you are eager to see Union Electric Service rates keep on going down, grab onto the rope behind the D's and pull with them. It's an open game; anybody can play.

The Electric Company

UNION ELECTRIC: Main Office—12th and Locust. Branches: 4013 Delmar, 3038 N. Grand, 3013 S. Grand

Electric Service Editorials

Making St. Louis a Smokeless City

St. Louis, with admirable air and rain drainage, is one of the healthiest big cities in the world.

An abundance of near-by cheap soft coal fuel has made it one of the smokiest big cities in the world.

St. Louis' smoky air means fuel waste, dirt, discomfort and some bad health.

St. Louis can banish most of its smoke by using electric energy instead of soft coal for power, for domestic work, and, as electric heating equipment improves, for space heating.

Electric Service should and ultimately will be used in every workshop, office, store and home, as freely as water. It is our aim to get this result in the St. Louis district.

Today there are two St. Louisans who could save money, time and labor, using Electric Service, for one that uses it.

Few big central electric stations sell as much as 50% of their 24-hour energy capacity. We don't. We sell our full capacity only a few hours of each twenty-four. We have constantly to increase plant capacity to meet the "peak hour" demand. Each such increase leaves a larger percentage of unsold energy in our 24-hour plant capacity.

Our big job is to sell that unsold capacity. The more of it we can sell, the lower average rates will go, automatically. Each new use of Electric Service by any customer, each new customer, helps cut rates for all customers.

Also, each such increased use of Electric Service helps make St. Louis a smokeless city.

The Electric Company

UNION ELECTRIC: Main Office—12th and Locust. Branches: 4013 Delmar, 3038 N. Grand, 3013 S. Grand. Six Offices in the County

Electric Service Editorials

No "Water" In Our Securities

You'll have read and heard a lot of talk about the plans of ambitious local politicians for "squeezing the water" out of Union Electric's securities.

This company is not in politics. It isn't going to be. It is attending and will attend strictly to its own business—Electric Service. But we take leave to print the truth when politicians try to put us in bad with the public.

The depreciated value of Union Electric's physical plant inside and outside of this city exceeds $26,000,000. Missouri Public Service Commission engineers and accountants found over $23,000,000 as depreciated plant values using in serving the city alone, last year. The plant couldn't be reproduced new, at present prices of labor and material, for a good deal more than $26,000,000.

The actual or going value of Union Electric's property and business—not assigning any value to franchises—exceeds the $31,105,000 total of its outstanding stocks and bonds.

Years ago there was a small percentage of water in the old company's securities.

The city government granted franchises right and left to little companies. Some had real plant value. Some had only a nuisance value.

The Electric Service business had to be concentrated by one company if St. Louis was to get a dependable, economical supply.

In absorbing its competitors Union Electric had some times to pay them more than their property was worth.

That wasn't Union Electric's fault; we paid real value for what we bought—including some nuisance values.

It was the fault of the city government, which didn't then understand that competition in Electric Service means duplicated plant costs and higher instead of lower rates.

That small margin of excess capital has since been made good by solid plant and property values built into the business out of earnings.

Not at our customers' expense: rates have steadily gone down while cost and value of service given them have steadily increased.

That "water" was made good at the expense of the dividend rate. Our investors for several years have taken less than the fair return to which State regulation entitles them, and the difference has been built into the property.

Union Electric is building for a long future, based on low rates, good service and public satisfaction.

The Electric Company

UNION ELECTRIC: Main Office—12th and Locust. Branches: 4013 Delmar, 3038 N. Grand, 3013 S. Grand. SIX OFFICES IN THE COUNTY

Electric Service Editorials

How the Public Limits Utility Rates

State regulation of public utility capital, earnings, rates, service and bookkeeping has been in force for five to a dozen years in nearly all the states, yet throughout the country advocates of municipal ownership are still writing and talking as if state regulation had never been thought of.

For example, Pearson's Magazine for May has an article telling how "a few rich men own nearly everything in the country." Of utilities it says:

"They own substantially all the street railways, electric light and gas companies. They capitalize our public utilities for as much as they see fit and charge rates accordingly."

Not even Rip Van Winkle could have packed so much ignorance of modern conditions into so few words. The facts are that—

The public utility companies are owned by hundreds of thousands of investors.

Under Missouri law a utility company can't issue a dollar of securities without permission of the people's Public Service Commission and every dollar so issued must be used in extending or improving the service.

If utilities have any "water" in their securities, put there before state regulation began, they are not permitted to base rates on it, nor to earn a dollar on it, and never will be.

No utility can charge any rate until the Commission approves it.

Any citizen with a grievance against a utility can readily get a hearing by the Commission on his complaint.

Fact is, public regulation has given the people RESULTS that some folks used to think could be got only by public ownership.

The "water" has all been squeezed out of the RATES, and is gradually being doled out of the securities.

Service has been bettered and cheapened.

Stock and bond jobbing has been stopped. Good utility securities are now among the safest of all investments for savings funds.

The utility business is rapidly being placed—Union Electric got there years ago without waiting for orders—squarely on a service-at-cost basis.

It has come to pass that the utility's best intangible asset is not its franchise—which has no earning or sale value—but its ability to give good and best service at least cost.

City governments are getting a liberal share of utility earnings, without having to invest a dollar of public funds in the business.

These big, practical gains of course do not satisfy the theorists, nor the statesmen who would like to make political use of utility revenues, but they do satisfy the average citizen.

The Electric Company

UNION ELECTRIC: Main Office—12th and Locust. Branches: 4013 Delmar, 3038 N. Grand, 3013 S. Grand

FOUR EDUCATIVE ADVERTISEMENTS OF ST. LOUIS CENTRAL STAT ON COMPANY

The fundamental purpose of the advertisements was to show the citizens of St. Louis and the surrounding territory that they were being taken into the confidence of the company. "A New Series of Get-Acquainted, Get-Together Talks" they were called in the initial advertisement. It was also stated that the truth about alleged "water" in the securities would be told, and that the reason why rates must cover a wide range to treat all customers justly would be explained.

One of the most interesting of the electric service editorials, following out the promise that "the New Union Electric Company's business policy" would be set forth, was entitled "Looking Forward to 1925." The company explained how it was planning increased capacity to take care of the great growth which it expected in "good old St. Louis."

A closing advertisement contained the warning:

"Our future rate reductions, heretofore announced as calculated for normal conditions, depend upon increased volume and density of service sales, and upon the cost of labor, capital, fuel and materials needed hereafter to provide the service. It is possible that war prices for some or all of these essentials may require us hereafter to ask the Public Service Commission to permit us to raise some rates temporarily so that we may not have to conduct the service for less than its fair cost. We hope, as you do, that this possibility may be avoided."

A better understanding between the company and its customers, a better knowledge of the business by employees and favorable comment of St. Louis daily newspapers were some of the definite results.

First Quarter Light and Power Income $121,300,000

Results of March Operation Show Earnings of $37,400,000, a Gain Over the Previous March of 15.1 Per Cent—Output 2,160,000,000 Kw.-Hr., an Increase of 25 Per Cent

DURING the first quarter of the current year the central station income from electric light and power, according to the returns received and compiled by the ELECTRICAL WORLD, amounted to $121,300,000, an increase over the first quarter of 1916 of more than $15,000,000 or 14.4 per cent. The output for the first three months of 1917 amounted to 6,500,000,000 kw.-hr., an increase over the corresponding period of last year of roughly 1,250,000,000 kw.-hr. or 23.7 per cent.

Based therefore on the returns for the first quarter of the present year, the earnings from energy sales for 1917 should total around $500,000,000, while the output should reach 26,000,000,000 kw.-hr.

As a result of March operations, earnings from light

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1916	1915	Per Cent Increase	1916	1915	Per Cent Increase
April	64	21,206,000	18,375,000	15.5	1,137,602,000	920,464,000	23.1
May	64	20,345,000	17,559,000	16.0	1,170,143,000	944,681,000	24.0
June	64	20,254,000	17,551,000	15.4	1,170,679,000	968,724,000	21.0
July	64	19,760,000	17,301,000	14.2	1,174,374,000	976,704,000	24.4
Aug.	64	20,502,000	17,861,000	15.0	1,262,575,000	1,015,805,000	22.4
Sept.	64	21,432,000	18,600,000	15.2	1,268,339,000	1,037,976,000	21.2
Oct.	64	22,882,000	20,164,000	13.5	1,347,502,000	1,125,132,000	19.9
Nov.	64	24,819,000	21,744,000	14.4	1,396,537,000	1,148,221,000	21.7
1917		1917	1916		1917	1916	
Dec.	62	25,306,000	22,029,000	15.0	1,345,883,000	1,112,280,000	21.0
Jan.	63	27,408,000	23,969,000	14.4	1,495,829,000	1,180,884,000	26.7
Feb.	62	25,033,000	22,164,000	13.0	1,222,473,000	1,022,667,000	19.8
March	58	21,716,000	18,879,000	15.1	1,253,087,000	1,002,938,000	25.0

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED BY SIZE

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
INCOME:										
Group 1	14.9	13.8	13.9	15.0	11.6	13.0	15.0	12.0	12.0	13.6
Group 2	17.7	16.8	15.7	20.4	19.2	17.7	16.6	19.0	19.7	22.0
Group 3	21.8	19.5	20.9	18.4	18.5	18.2	15.2	15.2	12.5	15.1
Group 4	11.0	9.0	9.5	11.3	13.5	12.8	12.3	15.5	10.3	18.3
Group 5	15.3	12.2	14.9	13.3	16.0	12.8	9.5	20.2	66.7	15.9
OUTPUT:										
Group 1	18.7	18.1	21.4	18.5	16.6	18.2	18.7	22.5	18.5	20.3
Group 2	17.5	22.9	33.0	32.9	31.1	27.2	20.2	30.5	24.0	37.8
Group 3	21.8	27.8	31.1	19.3	24.0	32.0	28.8	34.4	14.8	25.1
Group 4	19.3	16.1	23.0	26.0	20.4	19.7	21.0	30.5	20.2	26.0
Group 5	19.0	11.6	16.8	15.3	18.3	33.0	25.4	21.3	21.3	50.7

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
INCOME:										
Group 1	16.4	12.6	9.6	16.5	12.1	13.5	12.5	12.5	12.3	7.0
Group 2	19.8	20.6	15.1	25.5	21.3	20.0	30.2	16.1	18.4	19.4
Group 3	18.2	21.2	15.0	20.5	18.0	19.4	16.5	17.8	15.7	16.5
Group 4	7.2	6.2	11.1	10.5	15.4	16.0	16.0	22.0	12.8	25.8
Group 5	21.7	14.9	17.5	18.3	18.2	18.6	12.2	24.0	15.1	21.0
OUTPUT:										
Group 1	30.0	19.2	31.3	34.0	17.5	18.0	10.8	20.7	19.6	24.0
Group 2	26.3	14.1	32.0	37.7	35.0	24.7	18.2	24.8	18.5	22.9
Group 3	15.0	31.4	45.5	32.4	42.6	35.9	22.0	20.9	35.7	34.5
Group 4	21.0	26.6	39.4	32.9	48.9	40.0	55.2	73.8	38.1	32.7
Group 5	31.7	13.5	21.3	27.4	22.9	17.0	35.7	29.2	26.8	76.0

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States (Illinois Excluded)			Percentage of Industry Represented	Pacific and Mountain States		
			1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase		1916	1915	Per Cent Increase
INCOME	April	64	2,221,000	1,898,000	17.0	67	8,794,000	7,596,000	15.8	56	6,289,000	5,292,000	19.0	88	3,825,000	3,520,000	8.8
	May	65	2,103,000	1,788,000	17.0	67	8,226,000	7,131,000	15.4	56	6,085,000	5,123,000	18.7	88	3,874,000	3,469,000	11.6
	June	65	2,208,000	1,906,000	16.0	67	8,045,000	6,905,000	16.5	56	6,007,000	5,143,000	16.9	88	4,017,000	3,539,000	13.5
	July	65	2,130,000	1,875,000	13.7	67	7,832,000	6,621,000	16.4	56	5,926,000	5,095,000	16.3	88	3,755,000	3,493,000	7.6
	August	65	2,203,000	1,935,000	13.7	66	8,000,000	6,875,000	16.4	56	6,195,000	5,266,000	17.7	88	3,883,000	3,582,000	8.4
	September	65	2,315,000	1,982,000	16.8	66	8,631,000	7,445,000	16.0	56	6,505,000	5,537,000	17.8	88	3,979,000	3,644,000	9.2
	October	65	2,684,000	2,331,000	15.2	65	8,887,000	7,930,000	12.1	56	6,968,000	5,895,000	18.2	87	4,213,000	3,889,000	8.3
	November	65	2,912,000	2,516,000	15.7	65	10,061,000	8,859,000	13.5	56	7,410,000	6,313,000	17.4	87	4,246,000	3,947,000	7.5
	December	65	3,203,000	2,814,000	14.0	66	11,059,000	9,348,000	19.6	56	7,898,000	6,997,000	13.0	75	2,987,000	2,735,000	9.3
	1917		1917	1916			1917	1916			1917	1916			1917	1916	
	January	64	3,181,000	2,762,000	15.1	66	11,400,000	9,874,000	15.6	56	8,081,000	7,013,000	15.2	86	4,602,000	4,020,000	9.5
	February	64	3,039,000	2,686,000	13.1	65	10,249,000	9,021,000	13.6	53	7,345,000	6,439,000	14.1	86	4,239,000	3,886,000	9.0
	March	60	2,748,000	2,442,000	12.5	65	10,175,000	8,881,000	14.6	52	6,032,000	5,188,000	16.3	72	2,761,000	2,438,000	13.3
KW.-HR. OUTPUT			1916	1915			1916	1915			1916	1915			1916	1915	
	April	64	84,769,000	64,816,000	30.8	67	403,223,000	326,574,000	23.4	56	344,866,000	273,367,000	26.4	88	302,386,000	253,778,000	19.2
	May	65	84,719,000	64,318,000	31.8	67	409,529,000	333,585,000	22.0	56	345,860,000	275,328,000	25.6	88	328,793,000	266,599,000	23.2
	June	65	87,829,000	69,506,000	27.6	67	396,630,000	327,541,000	21.2	56	350,015,000	288,982,000	21.2	88	328,996,000	277,915,000	18.6
	July	65	85,317,000	71,160,000	19.8	67	401,179,000	333,771,000	20.3	56	350,708,000	287,407,000	22.2	88	325,647,000	279,285,000	17.4
	August	65	97,197,000	72,900,000	33.4	66	433,129,000	344,730,000	25.7	56	374,327,000	295,866,000	26.5	88	333,468,000	279,976,000	19.1
	September	65	98,350,000	73,343,000	34.2	66	446,534,000	369,815,000	20.8	56	387,626,000	307,485,000	26.2	88	335,817,000	288,332,000	16.4
	October	65	107,756,000	83,705,000	28.8	65	426,151,000	373,705,000	14.2	56	408,364,000	324,509,000	25.9	87	355,014,000	306,828,000	15.8
	November	65	111,873,000	89,015,000	25.7	65	533,252,000	424,746,000	25.6	56	415,491,000	334,044,000	24.4	87	346,847,000	293,518,000	18.2
	December	65	117,763,000	97,387,000	21.0	66	535,410,000	444,923,000	20.4	56	425,510,000	354,258,000	20.0	75	256,006,000	206,838,000	23.8
	1917		1917	1916			1917	1916			1917	1916			1917	1916	
	January	64	120,211,000	93,163,000	29.1	66	564,699,000	429,432,000	31.5	56	437,923,000	351,335,000	24.5	86	363,094,000	298,990,000	21.4
	February	64	110,114,000	88,324,000	24.7	65	418,407,000	341,877,000	22.5	53	357,175,000	311,199,000	14.7	86	325,182,000	272,691,000	19.2
	March	60	115,812,000	90,303,000	28.3	65	537,418,000	424,234,000	26.7	52	343,195,000	282,435,000	21.5	72	256,592,000	205,966,000	24.6

and power amounted to $37,400,000, an increase over the previous March of a little less than $5,000,000 or 15.1 per cent. The March output was 2,160,000,000 kw.-hr., which is considerably more than 400,000,000 kw.-hr. greater than the output in March of last year. The increase amounts to 25 per cent.

Both earnings and output showed increases in per cent as compared with previous months. In the New England States the increase in earnings shows a smaller per cent than in previous months as a result of the figures from the larger cities. This is probably affected considerably by the natural falling off in consumption for lighting.

Rate of growth in output apparently continues undiminished, which of course means that the actual growth in kilowatt-hours is becoming larger and larger. As has been pointed out before, this growth is largely

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED BY SIZE

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
INCOME:										
Group 1	16.4	16.8	16.1	16.2	10.7	13.7	18.8	15.0	13.0	14.3
Group 2	21.9	18.5	21.6	19.0	21.0	22.5	21.7	28.3	27.3	27.0
Group 3	12.0	14.2	15.0	14.0	14.6	13.0	13.4	12.5	10.4	15.1
Group 4	15.4	10.0	14.4	9.8	13.5	13.1	14.4	14.0	11.3	20.0
Group 5	15.2	13.0	19.4	8.9	14.3	16.0	14.3	11.1	11.8	12.5
OUTPUT:										
Group 1	13.1	23.4	28.5	23.6	19.2	20.8	21.5	32.5	22.0	21.3
Group 2	31.8	27.4	32.5	26.7	33.0	31.9	28.2	42.6	31.2	63.2
Group 3	13.2	11.5	16.0	24.7	4.5	19.0	15.9	27.2	21.2	21.6
Group 4	19.7	16.3	29.5	18.6	17.5	14.6	16.0	25.4	18.8	19.1
Group 5	11.1	13.5	20.4	1.3	1.5	5.8	6.9	9.4	17.0	3.2

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED BY SIZE

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
INCOME:										
Group 1	16.4	15.8	16.5	16.6	18.0	16.5	13.0	15.5	14.0	15.8
Group 2	17.5	17.3	21.8	21.5	21.0	17.0	16.0	17.8	18.7	23.8
Group 3	20.5	18.6	18.4	13.4	10.9	13.0	1.8	6.0	0.5	4.4
Group 4	17.5	17.5	10.7	20.0	19.7	16.8	15.5	19.8	16.3	18.0
Group 5	12.6	6.1	11.8	11.0	18.4	14.3	†	19.3	16.7	3.4
OUTPUT:										
Group 1	23.8	21.0	24.3	22.3	24.9	24.8	22.3	25.4	17.8	19.7
Group 2	12.3	25.7	36.4	40.0	31.7	29.7	24.4	29.0	23.6	34.5
Group 3	31.8	26.0	25.7	20.7	17.3	19.7	1.2	5.8	30.0*	4.5
Group 4	34.3	21.1	23.0	33.8	26.1	21.2	21.4	24.5	13.0	29.0
Group 5	4.0	8.6	6.1	13.7	28.2	16.8	9.9	15.5	17.1	24.5

*Decrease.
†Results omitted owing to insufficient returns.

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
INCOME:										
Group 1	7.5	4.7	5.5	6.2	4.2	4.5	4.0	5.4	7.2	11.3
Group 2	1.2	0.6*	0.7	4.9	1.3	3.0	3.6	7.5	5.5	0.6
Group 3	39.5	28.3	32.5	28.5	32.4	31.0	30.0	27.6	23.5	22.8
Group 4	3.6	1.0	0.5	11.5	7.2	0.4	0.6*	8.6	2.0	11.0
Group 5	12.8	13.2	13.0	11.7	13.5	17.1	11.1	20.3	17.1	16.0
OUTPUT:										
Group 1	8.0	10.0	6.3	7.1	5.2	8.0	8.6	11.0	14.0	18.0
Group 2	1.0	2.0	6.5	7.8	9.7	11.4	8.7	11.8	16.2	8.9
Group 3	74.5	56.1	57.5	60.0	63.7	61.3	48.0	59.5	36.8	36.3
Group 4	10.0	4.0	7.5	12.0	*0.5	4.2	2.6	15.2	14.0	26.5
Group 5	16.0	10.8	16.5	7.0	14.7	42.3	5.4	19.1	9.4	13.1

*Decrease.

new business, particularly industrial power load. The advancing cost of fuel in addition to the sudden demand for increased output has helped to make the operation of isolated plants unprofitable.

Compared with previous years, there is little increase on the whole from other than industrial load. Domestic consumers are not buying energy-consuming devices as freely as in the past, nor is it as easy to interest owners of houses to wire them under existing prices for electrical construction. Besides, there has been but little building activity other than for industrial purposes owing to market conditions for labor and material.

The demand for power, however, is actually becoming

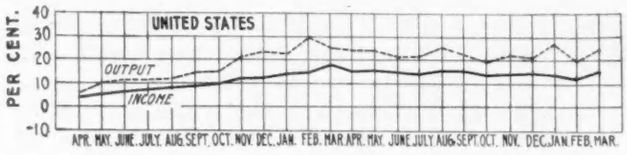


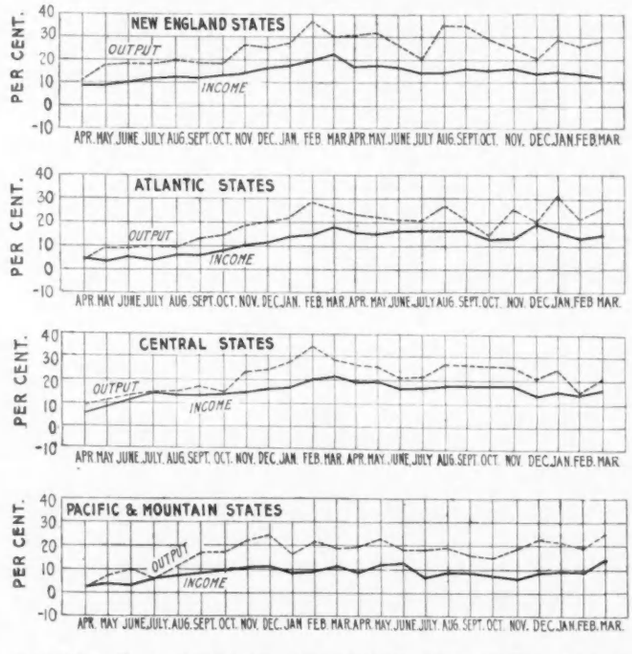
FIG. 1—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

greater. Shipbuilding yards and mines are particularly noticeable just now in the power market.

Government's Activity a Factor

The government program for a billion tons of shipping, backed up by the activity of private yards, means the consumption of large quantities of energy for some time. One plant in the East has recently signed a contract of such proportions with a shipyard that for the present it is unable to take on further power business. Coal mines in order to stimulate production, it is understood, are more and more increasing their consumption of electrical energy.

The accompanying curves show graphically the percentages of increase of both income and output given in Tables I and II. The remaining tables contain percentages of increase of income and output grouped



FIGS. 2 TO 5—CENTRAL STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

according to the size of community served. Group I contains those companies operating in cities having a population of over 100,000 inhabitants; group 2 those operating in cities between 50,000 and 100,000 inhabitants; group 3, between 25,000 and 50,000; group 4, between 10,000 and 25,000, and group 5, between 5000 and 10,000.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

EMERGENCY REPAIR OUTFITS

How Men and Materials Are Handled to Reduce Time Required to Effect Emergency Repairs

Several years ago when any burn-out occurred which required immediate repairs the street department of the Commonwealth Edison Company was hampered considerably in getting tools and material to the scene of trouble on account of the distance from the main toolroom and storeroom. To make tools available for just such cases the department has since arranged to place in several outlying substations tool kits containing all tools and materials necessary for making up high-tension joints of various sizes. Whenever material is used from one of these kits the foreman doing the work sends into the supervisor of tools a list of the material taken from the kit. The latter immediately replaces the material used and at the same time checks all material as well as tools contained in the outfit. Thus the equipment is kept complete in accordance with the printed list tacked on the inside of the tool-box cover.

On account of the amount of installation work which the Commonwealth Edison Company does, it is necessary to have an emergency delivery truck which during the day is kept busy delivering material to construction gangs. The driver, who keeps in touch by telephone with the supervisor of tools, is then available at any time to deliver tools and material in case of emergency. In order that no time shall be lost in making up an outfit, a kit of tools and material similar to that placed in outlying substations is held in readiness at the central toolroom, so that the emergency truck may at once deliver the necessary equipment to the scene of trouble.

BURNING-OUT OF STARTER

Relieving Situation Caused by Operating Motor with Starter on Intermediate Point

BY E. C. PARHAM

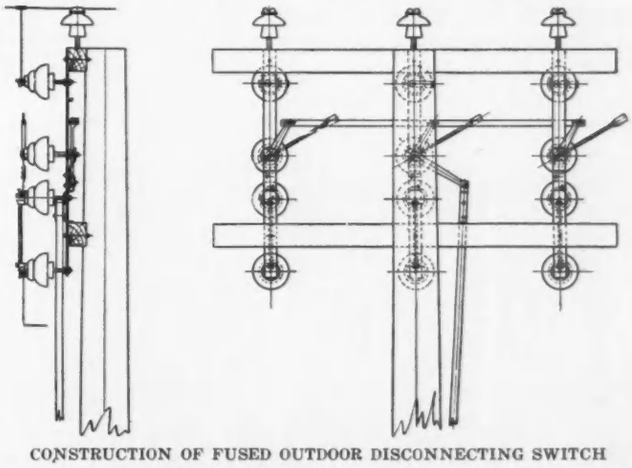
Motor-speed control by means of resistance in the armature circuit should be avoided ordinarily because of the great waste of energy in the resistance. The method is used in controlling direct-current traction motors, not because it is all that could be desired, but because it is the only practicable method available. The method is not so inefficient in this special application, because the two or more motors that are being controlled permit of series parallel and field control—combinations that make available several speed values without requiring any resistance in the armature circuit. Where a starting resistance is to be used for continuous running, this condition should be specified at the time of ordering; otherwise an ordinary starter will be furnished, and starters are not designed to withstand continuous running on intermediate positions unless so specified.

An operator in charge of producing steel bars and rods complained of the frequent burning out of the starting resistance of a 175-hp. motor that was applied to the driving of the rolls. Investigation disclosed that the manufacturer's recommendations as to the capacity of the fuses to be used were being observed. As the size of the stock handled by the motor had gradually been increased, a condition was reached where the motor at times was working at the rate of 400 hp. or more. Having tired of replacing fuses and noticed the relationship that existed between the blowing of the fuses and the ammeter readings, the attendant had adopted the practice of moving the starter handle back onto a resistance position whenever the current approached the critical value. As the motor was to be replaced soon and as the cost of a resistance grid or two was small compared to the losses incident to delay, the situation was relieved by arranging so that a whole resistance frame could be quickly replaced when a grid burned out.

FUSED DISCONNECTING SWITCH

Combination Apparatus Developed by Pacific Coast Company for Use on 11,000-Volt Lines

A combined disconnecting switch and fuse which may be operated manually from the ground before a lineman climbs a pole, thus enabling him to replace a fuse without hazard, has been developed by the Pacific Gas & Electric Company. All three legs of this switch are opened at once. The device is simple in operation, inexpensive



CONSTRUCTION OF FUSED OUTDOOR DISCONNECTING SWITCH

and has given satisfaction in the numerous cases where it has been used. The fuse consists of a wire incased in a glass or a porcelain tube held between two clips by means of screw clamps. These latter in turn fit into insulators which form the support. The switch and fuse are mounted directly on the cross-arm and poles supporting the line and transformers. It is the opinion of this company that this type of disconnecting switch and fuse is the only safe type to use on 11,000-volt work, irrespective of the details of design.

METHOD OF CONSTRUCTING BOILER FURNACE SETTINGS

Practice of a Large Company in Constructing Settings for Boilers to Minimize Air Leakage and Heat Radiation

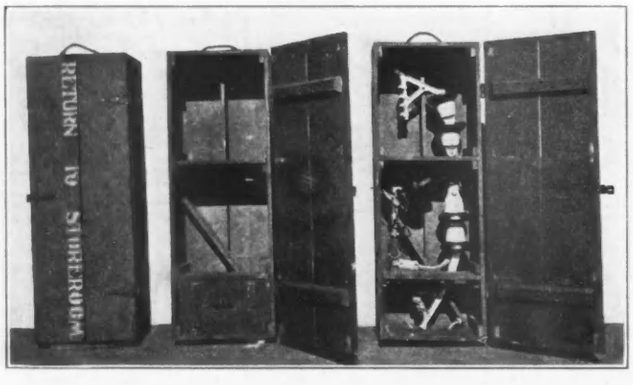
Radiation of heat and infiltration of air are two factors which should be given careful consideration in constructing settings for boilers. One large company has adopted the following practice in constructing the side walls for its boiler settings: The setting is built up with a 9-in. (22.8-cm.) wall of firebrick, a 4.5-in. to 9-in. (11.4-cm. to 22.8-cm.) wall of Armstrong nonpareil cork brick, or "Sil-o-cel" brick, and a 4.5-in. (11.4-cm.) wall of common red brick, upon which is put an air-tight coating of "Armorcote" roofing cement. The mechanical bonds between the walls are obtained by the usual header construction. High-temperature brick is used for the arches and walls where overfeed stokers or chain grates are used with temperatures running up to 2800 deg. Fahr. (1555 deg. C.). With underfeed stokers, such as the Taylor or Westinghouse, the temperatures will not run much above 2400 deg. Fahr. (1333 deg. C.), operating at a 200 per cent rating, if proper firing is used. Hence a high-heat resisting brick is not so essential as one with high mechanical strength and resistance to abrasion by slag.

ASSEMBLING AIR-BREAK SWITCHES AT STOREROOM

Units Compactly Stored in Special Cases by San Diego Operating Company to Obviate Necessity of Assembling in Field

Where a number of air-break line switches are used on high-voltage distribution systems (11,000 volts and up) it will be found advantageous to fit them up ready for service at the store yard, in order to reduce the time required for mounting them in the field. As shipped by the factory, knocked down, air-break line switches require considerable labor to set up.

To facilitate handling such units, the San Diego



COMPARTMENTS FOR HOLDING ASSEMBLED AIR-BREAK SWITCHES

(Cal.) Consolidated Gas & Electric Company utilizes wooden boxes specially constructed to contain them. Each box holds one single-pole unit made up complete, including strain clamps. By means of guides and blocks the element is held rigidly in place, thus obviating breakage in transportation. The small compartment with a cover, shown in the center box of the illustration, contains the miscellaneous hardware necessary for mounting the switch. Each set of three boxes required for a complete three-phase switch is painted a distinctive color to facilitate checking and handling. The switch shown in the figure is manufactured by the Pacific Electric Manufacturing Company.

THE VENTILATION OF UNDERGROUND SUBSTATIONS

Taking Air from Above Street Level or Separate Air Supplies for Sustenance of Life and Cooling of Machines Recommended

BY ALBERT MARTINEAU

Ventilation of underground substations is vitally important for the safe operation of the apparatus and the welfare of the operators who spend eight hours or more in these underground structures. At best it is not a simple matter to pass 50,000 cu. ft. (1400 cu. m.) or more of air per minute into a space 15 ft. to 40 ft. (4.6 m. to 12.2 m.) below the sidewalk, nor is it easy to draw so much air through a relatively small opening such as can be obtained in congested cities. The problem is somewhat simpler to-day than it was a few years ago, because the oil-filled transformer and induction regulator has taken the place of air-cooled apparatus extensively, thus reducing the amount of air required for cooling these pieces of equipment. On the other hand, the rating has increased enormously—the rating per unit of floor space being twice what it was a few years ago. Therefore greater quantities of air are required for cooling. Another factor is involved that has worked to the disadvantage of the men employed in these underground stations; that is, that the huge rotaries now in use give off large quantities of heat, make the station atmosphere dry and hot, and by their large armatures churn this air up, still further drying and mixing it with dust. One method of overcoming these objections is to inclose rotating machines in the same way that the air-cooled transformers are inclosed—a more difficult matter in view of their size and the need for frequent inspection and adjustment.

Air may be taken into underground substations in either of two ways—from the level of the sidewalk or from above the sidewalk. When the air intake is on the level of the sidewalk, dirt, dust and moisture are drawn in to the detriment of the air-cooled apparatus as well as the operators. Fumes from automobiles standing outside, newspapers and other litter are also drawn into the duct. In the winter ice is liable to clog the entrances. While periodic cleaning of the machines removes much of the dirt and dust, all is not removed, hence the amount of foreign matter lodged in the interstices and ducts accumulates surely but slowly, not only interfering with the passage of air but also acting somewhat as a heat-insulating coating. Air filters and washers would reduce trouble from this source considerably, but they require space, involve an initial and upkeep expense and cause another complication.

Taking in air on the sidewalk level is still more injurious to the men working in underground substations. Dust and dirt, especially when dry, are recognized as carriers of bacteria. In addition, the hot, dry air usually encountered in underground substations tends to irritate the nasal, bronchial and throat pas-

sages, even when bacteria are absent, by affecting the mucous membrane.

For these reasons it is better to take air from above the street level, say, six or more feet (1.8 m.) above. Where buildings prevent, as they usually do, the intake may be placed in the sidewalk. The duct must not only be high enough to prevent sucking in the dust from the street but must not inconvenience passers-by. The intake should be installed as close to the station as feasible because the greater the length the greater the pressure drop due to resistance to air flow; hence the more must be the expenditure for power to pass a given quantity of air into the station. Where the location of the substation and the walls of superstructures permit, a sheet-steel air duct may be installed against the side of the building. Two separate air supplies—one for the men and one for the apparatus, each maintained independent and isolated from the other—would be the solution to the problem that now exists.

HEAT-RESISTING COVERING

How to Make a Flexible Protective Tubing for Wire Not Exposed to Moisture

BY RENICE RADCLIFFE

Inexpensive tubing for electrical wires can be made in the following way: Coat a straight brass or iron rod heavily with melted paraffine and allow it to cool. Then mix one part of plaster of paris and two and one-half parts of water, adding a small quantity of lime. Tear muslin strips 1 in. wide (2.54 cm.) and dip into mixture. After allowing them to absorb all they will hold, wind them smoothly around the rod, working slantwise from end to end. Enough layers may be applied to give the desired thickness. When the plaster is thoroughly hardened heat the metal core until the paraffine is soft enough to permit removal of the rod. Tubing made in this way is a non-conductor, heat-resisting, slightly flexible and can be cut into desired lengths with a hack saw.

ENGINEERS AND THE WAR

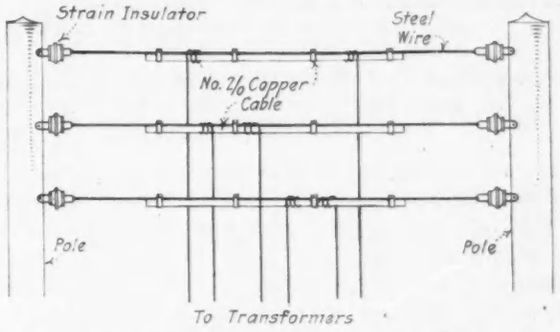
Granting of Special First-Class Engineers' Licenses During War Opposed in Massachusetts

E. W. Burdett, counsel for the Massachusetts Gas and Electric Lighting Association, appeared before the legislative committee on mercantile affairs at Boston recently, on behalf of a bill to permit the granting of special first-class engineers' licenses during the war. Representatives of large New England textile mills supported the measure on the ground that there may be a shortage of engineers as a result of selective conscription for war service. The bill was vigorously opposed by representatives of the International Union of Steam and Operating Engineers, the National Association of Stationary Engineers and other organizations of engineers and firemen, who contended that a surplus of men holding first-class licenses now exists, that there is no danger of a shortage, since most holders of such licenses in Massachusetts are above the probable maximum draft age, and that the granting of temporary first-class licenses, even with examinations as proposed, would lower the standard of engineers and prove dangerous to the public.

SUPPORTING OUTDOOR BUSES

Bus Conductors Attached to Steel Span Wire Terminating at Pole Supports in Strain Insulators

Steel anchor wire is used in the Greensboro (N. C.) substation of the Southern Power Company to hold in position the No. 2/0 copper cable buses that are used for a large transformer bank. When large cables are



METHOD OF STRINGING STEEL WIRES TO HOLD BUSES

fastened directly on insulators and strung for any distance, they sag and necessitate clumsy joints at the insulators, giving an unsightly appearance. By stringing steel wires as shown in the accompanying diagram and tying the cables to them at frequent intervals the cables are held rigidly in line. Besides improving the appearance of the buses this allows a saving in the copper which would be necessary to reach entirely to the insulators and to make a tie on them.

PORTABLE POWER-DRILL PANEL

Outfit for Connection Directly to Service Wires Without Auxiliary Apparatus in Series

A convenient portable power-drill panel used by the United Electric Light Company of Springfield, Mass., is illustrated herewith, the outfit being of the home-made variety. It consists of 1.5-hp. General Electric induction motor running at 1780 r.p.m. and belted to a 10-in. (25.4-cm.) upright drill at the bottom of a 1.75-in. by 15-in. (4.4-cm. by 38.1-cm.) plank about 10 ft. (3 m.) long. Speed reductions from the motor to the drill are obtained by the following sequence of pulley diameters: 3.25-in., 12-in., 4-in. and 10-in. (8.3, 30.4, 10.2 and 25.4-cm.). The motor is of the single-phase type, and can be connected to the line by snap-switch control, with no other equipment in circuit except the usual fuses. When considerable work is to be done in one place the panel is lag-screwed to a station wall. It has been found useful in switchboard erection and in other construction and maintenance work where local drilling of steel or wood is desirable to secure accurate fits.

PORTABLE DRILL PANEL

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

SALES DEPARTMENT CANNOT SELL ELECTRIC RANGES

An Important Part of the Electric Cooking Campaign at Milwaukee Is the Interdepartment Co-operation That Prevails

It's not often that a sales manager will admit that his department cannot sell anything that it is supposed to sell, but such was the admission of R. B. Snyder of the Milwaukee Railway & Light Company at the first meeting of the company's range committee, composed largely of members of departments other than sales. This committee consisted of the sales manager, the sales manager's chief clerk, the heads of the range department, trouble department, distribution department, installation department and electric shop sales force, the chief clerk of distribution department, and several installers.

At the first meeting of this committee Mr. Snyder, who acted as the chairman, explained the purpose of the meeting as follows:

"Our experience with electric ranges during the three or four months we have been dealing in them has shown that the sales department cannot sell an electric range. Experience indicates that the customer, largely to get rid of the salesman, will sign an order and say, 'Yes, we will try one of those ranges.' That, however, is as far as the sales department has been able to get.

"Now if ranges are to be sold the trouble department and the distribution department must do it, and it is essential that the ranges should be sold because they are now and will continue to be a large part of the revenue-producing apparatus on the company's lines.

"Right in this connection there is a suggestion which comes to my mind. I have found by examining the trouble department's records that it actually has been giving twenty-five-minute service on every trouble call. That means that on the average every trouble call reported is attended to by a member of that department within twenty-five minutes after it is received. With that kind of trouble service already established, it should be an easy matter for the trouble department to make electric ranges stay sold.

"It should be possible to install in the carhouses in the different sections of the city some kind of a box in which the elements for electric ranges could be stored. Then when the troubleman after completing each job calls up the office he can be told if there is any electric range trouble in that neighborhood, can go to the carhouse and get the necessary repairs and reach the range in a very short time."

This suggestion was enthusiastically received, and a committee consisting of the operating men, with the sales manager as an ex officio member, was appointed to design the box for storing elements in the carhouses.

In like manner it was pointed out that the installation department is a large factor in the sale of electric ranges. Without its co-operation in properly burning the paint off the ranges and testing them out before they are sent to the customer the sales department is powerless. In order to perfect the service in this respect it was agreed that every electric range order should be stamped across its face in red ink with the glaring word "RANGE." All orders marked in this fashion receive the same sort of attention that is accorded the largest power jobs.

After this work had been started and systematized, one of the troublemen came forward with another important suggestion, which was adopted. He pointed out that if he had a card file giving the name of each electric range owner, together with the type and make of the range, it would be of material assistance to him. When a trouble call from a range customer comes in, for instance, the woman of the house usually says, "My oven won't work," or "One of the plates on top of my range won't work." Before the card index was installed the trouble department had to ask her what type of range she had and what make it was. Usually she had to go to the stove and investigate. With the present system the card index is near the telephone so that when a range customer says her oven won't heat the trouble department gets her name, looks through the card index, locates the type of range on the card, and is then in a position to give the call to the first "trouble shooter" available.

It is in this way that the co-operative assistance of the operating departments of the company has been secured. Furthermore, when intercompany conferences on electric range practice were arranged, the men were largely from the operating department—only a few belonging to the sales department. This practice, which was contrary to that which is usual, was adopted because it was realized what a large and important part departments other than the sales department have to play in the actual selling of electric ranges.

APPLIANCES FOR EMPLOYEES PROVIDED WITHOUT CHARGE

A More Liberal Policy of Education of Salespeople in Use of Appliances Conducive to Larger Volume of Business

The general manager of electric shops for one of the largest central stations in the country recently said: "If I had my way about it, every clerk in our store would be given free of charge every electrical appliance that he could use in his home. I believe it would increase his ability as a salesman of these goods and would be a fine stroke of policy as well."

A few days later a salesman engaged in the actual selling of electrical appliances for a Middle Western company expressed his viewpoint on this question by saying: "How can we salesmen talk electrical appliances

without using them ourselves in our homes? How can we tell a woman how to iron if we know nothing about ironing? How can we talk suction cleaner if we never swept, beat or suction-cleaned a rug? Can we tell a 'prospect' that the electric toaster makes good toast, the electric percolator is pretty, the chafing dish is nice, that they make handsome electric appliances, and sell goods through such chatter? This class of talk does not sell merchandise.

"We must talk from our hearts, not from our mouths. We must know what these things will do—how easy it is to wash, iron, clean and cook with electrical appliances. In order to appreciate electrical appliances, it is absolutely necessary that we occasionally do the washing, the ironing and the cleaning of our rugs ourselves. It is necessary that we eat the crisp, hot, golden-brown toast made by the electric toaster and drink the delightful coffee made by an electric percolator."

In the foregoing paragraphs are viewpoints of men of two different classes most vitally interested in the sale of electrical goods. Their opinions are identical in trend, yet the universal policy of central stations on this topic is not as liberal as both would like to see it. Perhaps this is because the need for forcing appliance sales to their utmost has not been apparent up to the present time, but with the present high prices of construction material and growing overhead expense the need for building loads on existing lines that will not be of a peak character daily becomes more evident.

It is with these thoughts in mind that those who are responsible for the policies of commercial departments are considering a more liberal policy in the matter of educating the salespeople in the actual use of electrical goods.

MOVEMENT TO COMPENSATE EMPLOYEES FOR LEADS GROWS

So Far Confined Largely to Larger Central Station Companies, Although No Reason Why Smaller Utilities Should Not Do Likewise

Within the past year there has been a very noticeable tendency on the part of larger central station companies —and there is absolutely no reason why the movement should not spread rapidly to the smaller companies— to stimulate the interest of employees toward helping the company increase the load on its lines by recompensing the employees in some manner for all leads furnished.

One of the latest companies to inaugurate such a system is the Edison Electric Illuminating Company of Brooklyn, which offers prizes monthly for leads resulting in business, the value of the prizes depending on the character of the lead. The details of the Brooklyn system have been announced as follows:

> In order to stimulate the co-operation of all employees in notifying the sales department of prospective business, of customers interested in the use of appliances, and customers' complaints which would not otherwise come to the attention of the company, the leads have been classified in the order of their importance and suitable awards will be made each month accordingly.
>
> The nature of each employee's work, the facilities offered him to secure leads and the importance of the result of the leads will form the basis for awarding prizes.
>
> The order of importance of leads is as follows:
>
> 1. For the electrical equipment of unwired premises along the line of the company's mains.
> 2. For the name and address of any institution or enterprise where a private plant is in use, provided that this plant is not already on record in the census of the power engineering bureau.
> 3. For the sale of appliance or appliances by the Edison Shop or branch offices. The information to be conveyed by this type of lead is to be the result of the employee having interviewed and interested a "prospect" in the purchase of some specific article or articles indicated in the lead.
> 4. For information concerning any legitimate complaint or grievance of a customer.
>
> Leads should be forwarded to the chief clerk of the sales department.

KEEPING DOWN DELINQUENCIES BY MEANS OF DAILY REPORTS

Methods Adopted by Medium-Sized Ohio Property Found to Have Worked Out to the Satisfaction of the Company

A few years ago the American Gas & Electric Company, through its monthly publication, the *A-G-E Bulletin*, started throughout the subsidiary properties a campaign to reduce delinquencies. No general plan

DELINQUENT ACCOUNTS RECEIVABLE
DAILY REPORT

This statement must be made up daily by the Superintendent, Signed by him, and mailed to the Newark Office with the daily cash report.

Delinquent Balance 15th day of 19

Less Collections Reported to date

BALANCE

COLLECTIONS 19

POLIO	NAME	AMOUNT

TOTAL

BALANCE

Signed Superintendent.

FORM USED IN NEWARK, OHIO

for use by all companies was adopted—each had to work out its own salvation. All are situated in medium-sized communities. A description of the early progress of the campaign will be found in the April 17, 1915, issue of the ELECTRICAL WORLD.

At the Newark office of the Ohio Light & Power Company, one of the subsidiary properties, a daily report on collections of delinquent accounts must be made by all of the superintendents reporting to that office. The report, similar to the one shown here, is 5 in. by 9¼ in. (12.90 cm. by 23.50 cm.) in size, printed on light-weight paper.

E. S. Browne of the Newark office, writing in the

May issue of the *Bulletin*, says in regard to the daily report:

"We found that in some of our towns the matter of collections was being neglected, and in order to keep the matter before the superintendents daily, we adopted the daily report of collections of delinquent accounts. It has worked out very satisfactorily and has decreased to a marked degree our delinquents as compared with our twelve months gross."

COMMUNITY APPRECIATION OF RATE FUNDAMENTALS

Will Brush Away Large Amount of Utility's Rate Troubles if Done Before Danger Comes to a Head

In a paper read before the recent Southwestern Electrical and Gas Association, Secretary H. S. Cooper concluded with the following apt remarks:

"Long before the 'danger' actually comes to a head the utility should educate its community to the knowledge that any local conditions in one community which are more unfavorable to low costs of utility operation than they are in another city will tend to give the first city higher utility rates independent of any action or intention of the utility itself.

"Once a community is made fully to understand and appreciate this point, a large amount of the utility's rate troubles have been brushed away. Also if a community is made fully to understand and appreciate what these local conditions are and how they affect the cost of operation a still further amount of the rate troubles will be eliminated. This presupposes, however, that the rates of the utility have been made on some equitable basis and give only a reasonable return to the utility."

WOMEN PROVE SUCCESSFUL AS CENTRAL-STATION SOLICITORS

Those Who Really Need Work Make a Success of Selling the Low-Priced but Large Energy-Consuming Devices

In the opinion of the sales executives of the Duluth Edison Company, men solicitors are all right for selling washing machines, vacuum cleaners, electric ranges and the larger equipment on which there is sufficient profit to pay high salaries. They cannot be used economically, it is thought, to sell the smaller appliances which are the real revenue producers but which do not permit the salesman to make a large profit on each individual sale. For this reason the Duluth Edison Company employs women as its house-to-house canvassers on the smaller devices which must be sold to load the lines. In every case the women who are hired must be in need of the jobs they seek to make a living. Only women of this type have been employed, because experience has taught that they are dependable, that they work hard to sell goods and that they stay with the company indefinitely. Women with these qualifications, it is believed, if they have the least originality and sales ability, will make good in this type of work. At Duluth these saleswomen are paid $50 a month and $1 per kilowatt for all load placed on the line over and above 25 kw. At this work they make salaries that are above what they could make in other positions which they would be able to fill.

Their work is carried on systematically. When they start out in the morning they have a pack of cards, each one of which is a record of some customer. The card gives the customer's name, tells what appliances have been sold to the customer and when the last call was made. These customers are called on and the appliances looked over. If any are out of order, the saleswoman reports it to the company, which sends a man to get the defective device, repair it and return it free of charge. Before the inspection is over the canvasser usually finds that the customer is interested in some other device, and either makes a sale or marks the card so that it will be returned to her for a future call.

By following out this plan of selling the smaller appliances, the Duluth company is able to avoid the trouble that comes from being constantly obliged to train solicitors. Furthermore, it is believed that the use of women in this capacity accomplishes more for the company than would the use of men of the caliber it could afford to pay.

ECONOMY OF ELECTRIC TRUCK OVER USE OF HORSES

Statistics Compiled by New York Electric Vehicle Association Show Saving of $800 a Year—Items Overlooked by Horse Owners

The New York Electric Vehicle Association has compiled some interesting facts and figures relating to the cost of operating and maintaining a small horse-drawn delivery outfit consisting of three horses and two small trucks or wagons. The purpose of presenting these data is to show the comparative cost of this type of delivery system and the cost of maintaining and operating an electric vehicle capable of doing the same work.

The following is an illustration of correct accounting for one year for three horses and two wagons, based on actual conditions in New York City:

Board, at $1 per day	$1,095.00
Shoeing, at $2.25 per month	81.00
Services of veterinary	30.00
Clipping	5.55
Repairs and painting of wagons	200.00
Repairs to harness	45.00
Amortization for horses, at 20 per cent (assuming the value of a horse at $200)	120.00
Amortization for wagons and harness (assuming value at $375)	75.00
Insurance	25.86
Interest on investment	103.50
Total	$1,780.91

An electric vehicle of the type capable of doing the same amount of work as this horse and wagon equipment, the association states, can be operated and maintained at a cost from $900 to $1,000 a year. This figure is based on a compilation of costs exactly the same as for the horse-drawn equipment.

In addition to the economy of approximately $800 per year, there are many other advantages in favor of the electric vehicle. Its life is from twice to three times that of a horse, its average working speed is more than double the speed of a horse, it is cleaner, and it requires less space.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

RADIATION FROM STRAIGHT AND HELICAL FILAMENTS

The Difference in Brightness of the Interior and Exterior Surface of the Helical Filament of the Gas-Filled Tungsten Lamp Explained

ATTENTION has often been called to the fact that the interior surface of the tungsten filament of an incandescent lamp has a higher intrinsic brilliancy than the exterior surface. In an investigation conducted by W. W. Coblentz at the Bureau of Standards and shortly to be published in Scientific Paper No. 300 an attempt was made to determine the reason for this difference.

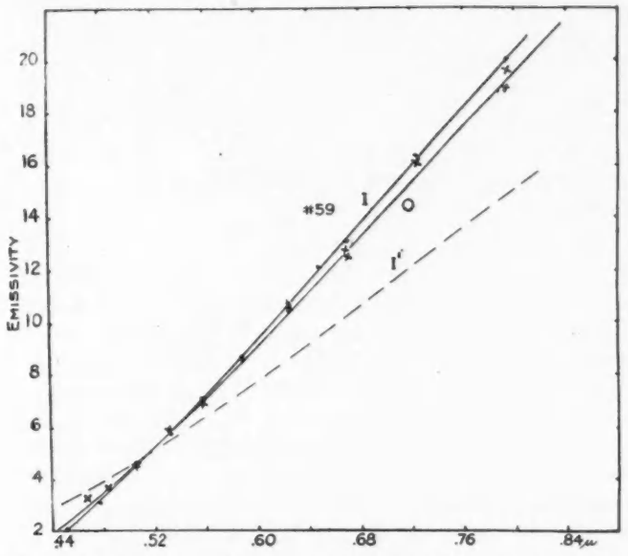


FIG. 1—DISTRIBUTION OF ENERGY RADIATED FROM INSIDE AND OUTSIDE OF HELICAL FILAMENT OF TUNGSTEN

Measurements made with a physical photometer showed that for the gas-filled lamp used the brightness of the interior was 1.87 times that of the exterior surface. This difference might be due to a difference in temperature or to a difference in quality of the radiation. The researches of Worthing and of Langmuir indicate that the difference in temperature could not be greater than 5 deg. C., whereas a difference of 200 deg. C. would be necessary to account for the observed difference in brightness.

If the increased brightness observed within the helix is due to blackening of the radiation, caused by reflections, then the spectral-energy curve should be much higher and unsymmetrical on the long wave-length side of the maximum emission, as compared with the spectral radiation from the outside of the turn of the helical filament, for it is well established (both experimentally and theoretically) that in metals the spectral-energy curve in the infra-red falls very much below the spectral-energy curve of a black body at the same temperature.

An examination of the spectral-energy curves from the two types of filament was undertaken to discover what difference in quality of radiation there might be. The first results of this investigation were published in the ELECTRICAL WORLD for 1914 (Vol. 64, page 1040). More accurate measurements have since been made.

One series of spectral-radiation measurements was made (with a vacuum spectrobolometer and fluorite prism) upon the helically wound filament and upon the hairpin filament set to the same emissivity, in the visible spectrum, as the outside of the turn of the helical filament. For this purpose the lamps were calibrated by operating the hairpin filament at its normal temperature (wave-length of maximum emission = 1.06 microns) and adjusting the current through the spiraled filament so that the outside of the surface of the turn had the same emissivity (in the visible spectrum), and hence the same intrinsic brilliancy, as the straight wire.

After reducing the energy curves to a common ordinate in the visible spectrum it was found that the area of the energy curve of the spiraled filament was only 7 per cent larger than that of the energy curve of the hairpin filament owing to "blackening" of the radiation in the region from 1 to 3 microns. While this proved, of course, the presence of some reflected light from within the helix, it did not account for the 90 per cent increase in the visible spectrum.

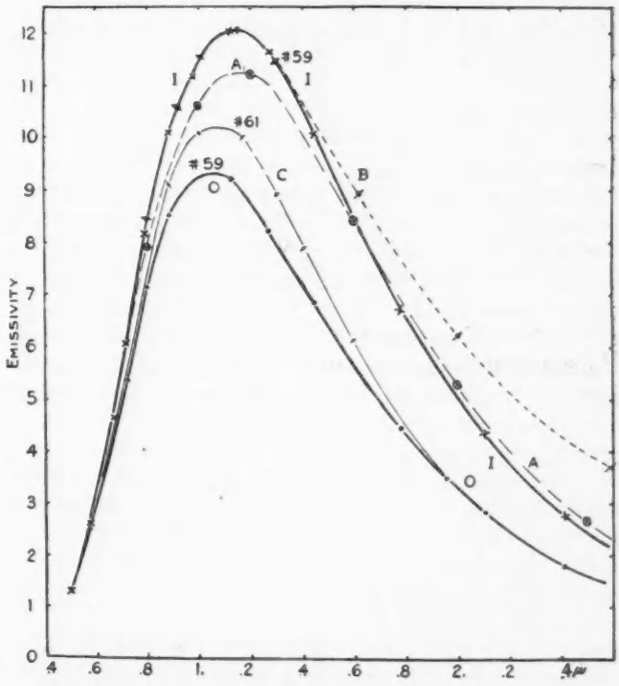


FIG. 2—RADIATION FROM INSIDE AND OUTSIDE OF HELICAL FILAMENT, FROM HAIRPIN FILAMENT AND FROM BLACK BODY

It was evident that in order to reach definite conclusions in this matter it would be necessary to determine the spectral-energy curves of a small area on the

inside and outside of the turn of the helix. This is a much more difficult problem than the one in which observations are made on the radiation from a long filament because of the reduction in energy and difficulty of projecting a satisfactory image of the spiral upon the spectrometer slit. However, during the past year the work was undertaken anew, using a mirror spectrometer, fluorite prism and bismuth-silver thermopile.

The data for the visible spectrum are given in Fig. 1. Curve I gives the distribution of energy radiated from the inside of the turn. Similarly, curve O gives the energy distribution of the radiation from the outside of the turn of the helical filament of the tungsten. In the latter the ordinates were magnified 2.2 times in order to superpose the curves, and hence the errors are magnified as compared with curve I. In each curve the data represent two distinct series of measurements. It is to be noticed that the two curves intersect at a very acute angle, which is so small that in the earlier tests the difference in the slope of the two curves was attributed to experimental errors.

The curve O indicates that the light emitted from the outside of the turn is relatively stronger in the blue than the light emanating from within the turn of the helix. That is to say, the light from within the helix is redder than that from the outside of the turn. This indicates that the increased brightness of the light from within the helix is caused by reflections which deplete the blue as compared with the red.

The distribution of the energy radiated from the inside of the turn of the spiral is shown in curve I of Fig. 2. Similarly, curve O gives the distribution of spectral energy radiated from the outside of the turn of the wire. Curve C gives the energy distribution of the hairpin filament when set to the same brilliancy as the outside of the turn of the helical filament. The lack of coincidence of curves O and C may be due to a slightly higher temperature (perhaps 10 deg.) of the hairpin filament.

Fig. 2 furnishes evidence which will account for the increased brightness of the inside surface on the basis of multiple reflection of light. On account of multiple reflections, the light from the interior should be redder and the light from the exterior relatively more intense in the blue. Making use of the known reflecting power of tungsten and applying the data to curve O on the assumption of three internal reflections, curve A is obtained, and this comes near to coincidence with the observed curve I for the radiation from within the helix. The reflection coefficients used were determined at room temperature, but it is well known that in the infra-red region the reflecting power of metals decreases with rise in temperature. Hence an application of a temperature correction would bring the computed curve closer to the observed curve.

The ratio of the areas of the curves I and O is 1.36, which indicates that the radiation from within the helix is more nearly like that from a black body, and as a result the luminous efficiency has been reduced by 36 per cent. In spite of this reduction in luminous efficiency there is a net gain in over-all efficiency due to the saving of energy usually lost by conduction and by convection. It is in order to effect the latter saving that the lamp filament is wound helically.

An examination was made of the light from the inside of the helix by using a Nicol prism. The regions of greatest brightness showed marked polarization of the light while that from the outside of the turn showed but little polarization. This would indicate that the polarization is due to the reflection of light from adjacent filaments.

Generation, Transmission and Distribution

Card Representation of Variation in Electrical Supply.—In a recent issue of the *Revue Générale de l'Electricité* M. A. Ticier describes an ingenious method of representing the variations in central station supply. Each day the draftsman responsible for the tabulation of data relating to supply cuts out a sheet of cardboard the contour of which represents the scale of the load at each moment during the previous twenty-four hours. The contour cards thus prepared are mounted side by side, the complete set for a year being easily contained in a box 19.6 in. long and 7.9 in. wide (50 cm. by 20 cm.). In this way the station secures an exact representation of all load fluctuations. Such models are very useful not only in recording the variations in different seasons of the year and between different localities, but as presenting the results of any temporary breakdown. They have also furnished a useful lesson to those of the general public who would not otherwise have appreciated the fluctuations in load to which a station must accommodate itself and the resulting necessity for the several special methods of charging.—London *Electrician*, May 4, 1917.

Pressure Harmonics in Polyphase Systems and Windings.—B. Hague.—The conclusion of a long mathematical paper which is summed up by the author as follows: In the first part of the paper the general properties of harmonics in a polyphase system of pressures is discussed, while the second part deals with the effect thereon of the armature winding from which the polyphase system is derived. The purity or otherwise of the shape of the pressure wave of an alternator depends first on the harmonics present in the flux-density distribution of the machine and secondly on the "winding factor," a function of the arrangement of the winding on the armature periphery. The shape of the flux-density curve and the character of the polyphase system required from the winding being known, the tables in the concluding part of the artiele give at once the relative magnitudes of the pressure harmonics present in the emf. wave of the phases, the actual behavior of these harmonics in the system then following from the theory discussed in the first part, whether the phases of the winding be independent or interlinked.—London *Electrician*, March 30, 1917.

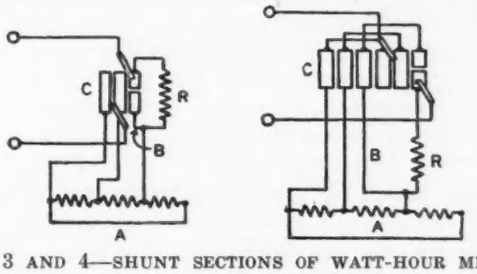
Installations, Systems and Appliances

Rating of Intermittent Motors of Large Output.—H. H. Broughton.—When an intermittent motor follows a definite cycle of operations the root-mean-square (r.m.s.) method, or a modification of it, is perhaps the most convenient and reliable method of determining the rating to be given to the motor. The principle underlying the r.m.s. method is well known, but the application of the method varies with different firms. In consequence of this variation motors intended for the same duty may have very different name-plate sizes. The author gives as an example the motor required for driving a single-stage winder for a compound shaft, and shows that the three methods in use give widely

different results. Thus by the true r.m.s. method it is found that a motor of 667 hp. is required. Making allowances for the lower efficiency of the cooling surfaces during the reduced speed and standstill periods of the cycle, according to one method the result is a rating of 761 hp., and according to another method the rating is 741 hp. Since the duty is known and as the temperature rise is limited by the specification, this means that what one firm calls a 761-hp. motor another firm will call a 667-hp. motor. This tends to give the user the impression that he is getting better value for his money from one firm than from another, whereas the motors are alike. In view of the large number of motors in use rated in these varying ways it is recommended that the engineering standards committee frame rules so as to get rid of the feeling of uncertainty which prevails among those who use the r.m.s. method.—London *Electrician*, May 4, 1917.

Units, Measurements and Instruments

Direct-Current Watt-Hour Meters.—An English translation in abstract of a recent German article by R. Ziegenberg on improvements in direct-current meters of the Thomson type. The principal new features are the use of a flat-coil armature and an electromagnetic connection between meter and counting train. The chief reason why disk-type armatures have not hitherto gained much acceptance in this connection is that sector coils of too small an angle have been employed. Increasing the number of armature coils ren-



FIGS. 3 AND 4—SHUNT SECTIONS OF WATT-HOUR METER

ders the meter torque more uniform, but it also reduces the actual value of the torque. Current flow in adjacent radial conductors is in opposite directions (save in the radial conductors connected to the commutator bars undergoing commutation at the moment), and when such contraflow occurs in a single field, the net torque due to the conductors concerned is zero. The way to obtain a high driving torque from a light-disk armature of low resistance is to employ wide-angle sectors, and not more than two armature coils per field pole, but preferably fewer. Adjacent radial conductors are then in fields of opposite polarities when they are carrying current in opposite directions or, at the worst, one set of radial wires is in only a weak field of the same polarity (near the neutral zone). There is no particular mechanical difficulty in the construction of a disk armature, and, though the diameter of the latter be about 50 per cent greater than that of the alternative drum-wound armature, the construction as a whole is simpler and more compact. Furthermore, when using an electromechanical recording train, instead of directly geared mechanism, the total saving in spindle length is about 50 per cent. A four-pole field system and six-coil armature represents a satisfactory compromise between simplicity of construction, high driving torque and minimum dead weight, and resistance in peripheral copper (which is ineffective as regards driving torque). For driving the recording train a suitable source of variable current is needed. Figs. 3 and 4 show the shunt circuits only of a watt-hour meter with three-section armature *A* and three or six commutator bars *C* respectively. Fig. 3 corresponds to a two-pole field system, and Fig. 4 to a four-pole field system, each armature section in the latter case consisting of two coils opposite to each other on the armature and connected in series. [An ingenious method of effecting the connection between diametrically opposite commutator bars in this case (Fig. 3) is to form each pair of such bars from a single silver strip bent to U-shape. The limbs of the U form the two contact bars, while the end piece forms a perfect and reliable cross connection and, being drilled, serves also for attachment of the commutator elements to the spindle. Insulating disks are placed between the three U-pieces, which are spaced circumferentially equidistant on the spindle in building up a six-bar, three-section commutator.] It will be seen that in both cases one commutator bar is divided at the center of its length, and the brushes are set so that during each revolution of the armature connection is completed once through the direct lead *B* and once through the resistance *R*. When the latter is in circuit the potential difference across the brushes is increased by the amount *IR* (*I* being the armature current). This pressure increase suffices to actuate the recording magnet, which is connected across the brushes. For convenience and security, the commutator is made rather longer than usual when this arrangement is employed. A central insulating ring is added (primarily to support the inner ends of the divided bar), and one brush bears on the upper and one on the lower half of the commutator.—London *Elec. Rev.*, April 27, 1917.

Telegraphy, Telephony and Signals

Range of Wireless Stations.—R. CHENEVIX TRENCH.—The author introduces modifications into the Austin-Cohen empirical formula for the range of wireless stations so as to take into further account the effect of actual working conditions. The results obtained are illustrated by means of a number of curves, and the use of these curves is finally illustrated by the working out of certain empirical examples.—London *Electrician*, April 20 and 27 and May 4, 1917.

Miscellaneous

Blind Operators in the German Electrical Works.—According to the *Elektrotechnische Zeitschrift*, the authorities in Brandenburg have been endeavoring to find occupation for men who have lost their eyesight, and a number are now being employed in the Siemens-Schuckert Works. They are found quite serviceable for such work as gaging small parts, stamping numbers, packing small articles and testing fuse plugs acoustically. A room is given up to their working, and special precautions are taken in the location and fencing of machines and the elimination of sharp projections that might cause injury. The workers are paid a minimum wage of 28 pf. (about 7 cents) per hour, but some earn as much as 55 pf. (about 14 cents). It is stated that they prefer machine work to hand work, the noise of the machine being apparently a useful guide to the progress of each operation.—London *Electrician*, May 4, 1917.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ELECTRICAL COUNCIL OF UNDERWRITERS' LABORATORIES

Second Meeting of New Organization in Chicago Well Attended and Much Business Affecting the Industry Is Transacted

The second meeting of the newly organized Electrical Council of the Underwriters' Laboratories was held at the principal office and testing station at Chicago on May 23 and 24. The following members attended:

Dana Pierce, chairman, New York; W. J. Canada, Bureau of Standards, Washington; H. H. Clark, Bureau of Mines, Pittsburgh; H. S. Wynkoop, Department of Electricity, city of New York; V. H. Tousley, Department of Electricity, Chicago; H. F. Strickland, Hydro-Electric Power Commission of Ontario, Toronto; L. A. Barley, Rocky Mountain Fire Underwriters' Association, Denver; R. C. Bird, Fire Underwriters' Electrical Bureau, New York; W. S. Boyd, secretary Western Association of Electrical Inspectors, Chicago; G. E. Bruen, Suburban Fire Insurance Exchange, New York; B. W. Clark, Public Lighting Commission, Detroit; W. Devereux, Philadelphia Fire Underwriters' Association, Philadelphia; J. C. Forsyth, New York Board of Fire Underwriters; B. H. Glover, Underwriters' Laboratories, Chicago; W. D. Matthews, Chicago Board of Underwriters, represented by F. G. Waldenfels; A. H. Miner, Underwriters' Bureau of New England, Boston; C. W. Mitchell, Board of Fire Underwriters of the Pacific, San Francisco; I. Osgood, Boston Board of Fire Underwriters; A. M. Paddon, Underwriters' Association of New York State, Syracuse; E. H. Sigison, Buffalo Association of Fire Underwriters; R. P. Strong, Louisiana Fire Prevention Bureau, New Orleans; A. G. Wilbor, Factory Insurance Association, Hartford, Conn.; F. A. Cambridge, city of Winnipeg, Manitoba, Canada; and F. O. Evertz, Department of Electricity, Columbus, Ohio.

The meeting was the first business session of the council. A lively interest was manifested by members in discussions of the scope of work and methods of procedure to be followed and the results to be sought in the elaboration of standards for construction of tests of electrical appliances and the regular work of examining and testing appliances under such standards.

An extension was made to the existing standards on metal molding to include surface metal raceways of one-piece design for use on two-wire circuits not exceeding 1320 watts capacity, and under this extension the new surface wiring raceway known by the trade name of "Wiremold" was listed as standard.

On the subject of fuses action was taken directing that the staff engineers undertake an investigation with the view to reporting to the Electrical Council for consideration at a future date suggestions for a possible set of specifications, method of testing, supervision and field follow-up of the details of design, construction and performance under test of so-called refillable fuses.

W. J. Canada of the Bureau of Standards and H. H. Clark of the Bureau of Mines made interesting statements concerning present tendencies in the construction of electrical devices from the viewpoint of accident hazards. A resolution was adopted calling attention of manufacturers to the desirability of paying more attention to these features in the design and construction of appliances.

The newly developed standard on armored cables was formally adopted.

Other subjects of discussion included construction and use of miniature motion-picture machines and their special films, electrical heaters and pressing irons, ground clamps, bell-ringing transformers, and disconnecting plugs or receptacles of large capacity for battery-charging circuits and similar uses.

PROMPT REPAIRS FOLLOW WESTERN CYCLONE DAMAGE

Transmission Lines Enable Central Illinois Public Service Company to Restore Electric Service in Cyclone District

Without calling in outside help, the Central Illinois Public Service Company, with headquarters at Mattoon, is rapidly repairing the damage to its property done by the cyclone which struck several Middle Western states May 26. While full details are not yet available, the Mattoon power house, the Kincaid power house and transmission lines both east and west of Mattoon were operating within a few hours after the storm had passed. A short line between Mattoon and Charleston which was partly destroyed is also being replaced rapidly. At the Charleston power house George Kilgore and Jesse Huddleston, engineer and fireman, were killed by the falling of the power house building. It is impossible as yet to arrive at a definite figure for the entire damage, but when the severity of the cyclone and the wide area covered are considered the Central Illinois Public Service Company is fortunate to have escaped with no greater loss. That the transmission lines could be repaired so rapidly is further evidence of the value of interconnected systems.

Jovians Promote Business

To promote the idea that business must continue actively during the war the Jovian Order has designed a large sticker for free distribution. The sticker is 2 in. in diameter and it is printed in red and white. Copies of the sticker in desired quantities will be forwarded upon receipt of a request by the Jovian Order, 1415 Syndicate Trust Building, St. Louis, Mo. As shown by the illustration, the sticker is distinctly Jovian in appearance.

DINNER POSTPONED BY ASSOCIATED MANUFACTURERS

On Account of National Registration Day, Meeting with Chairmen of the Sections Is Postponed to June 20

The proposed dinner by the board of governors of the Associated Manufacturers of Electrical Supplies to the chairmen of the various sections has been postponed from June 5 to the evening of June 20. The dinner will be at Delmonico's, New York, at 7.30 p. m. on the latter date. The change was made because June 5 is registration day under the universal service law.

The board of governors will meet at 2.30 p. m. on June 20 at the association offices.

The meeting of the fan motor section is to be held at the Marlborough-Blenheim Hotel, Atlantic City, N. J., on June 7 and 8 instead of at the offices of the association, New York.

The meeting of the lighting fixture section, scheduled originally for June 5, has been postponed to 2 p. m. June 8, at the association offices, New York.

ELECTRICAL SUPPLY JOBBERS PLAN TO INCREASE MEMBERSHIP

Conditions in Jobbing and Contracting Trade in New York City Revealed by W. L. Goodwin, Who Found Lack of Organization There

At the concluding sessions of the meeting of the Electrical Supply Jobbers' Association at Hot Springs, Va., last week, inspirational and thoughtful addresses were made by Arthur H. Elliott of Oakland, Cal., secretary of the Pacific Division of the association, and W. L. Goodwin, formerly vice-president and sales manager of the Pacific States Electric Company and now with the General Electric Company in New York City. The former told of electrical commercial conditions on the Pacific Coast in a very interesting manner. The latter spoke of his recent work among the jobbers and contractors in New York City, and the situation he unearthed came as a revelation.

Mr. Goodwin's reputation as an organizer and the excellent work he did for the electrical industry on the Pacific Coast are very well known, so that his remarks were listened to with a great deal of attention. On coming to New York, Mr. Goodwin delved deeply into the condition existing in the jobbing and contracting trade with a view to getting at the bottom of things. He discovered that there are forty-two jobbers in the greater city and only fifteen of these were members of the Electrical Supply Jobbers' Association. There are also fifteen contractor organizations, having a total membership of 310. However, the great bulk of the contractors and dealers in New York are not affiliated with any organization whatsoever, Mr. Goodwin having so far succeeded in discovering 6200 contractor-dealers. In his attempt to clean up the situation Mr. Goodwin has already succeeded in convincing the contractor-dealers of the necessity for organization, and many are now being enrolled in an association which meets weekly. Speaking specifically of jobbing, he emphasized the necessity of the association increasing its membership in Greater New York and harmonizing conflicting interests so as to bring order out of chaos and stabilize jobbing conditions.

At the final session the recommendation of the Atlantic division to reduce the initiation fee from $1,000 to $500 was passed, and it is the expectation of the division to strengthen its local organization.

BIRTHDAY TRIBUTE TO HENRY L. DOHERTY

Occasion of Forty-seventh Birthday Recognized by a Dinner Attended by 117 Members of the Organization

On the occasion of the forty-seventh birthday of Henry L. Doherty, 117 members of the Doherty organization met at an anniversary dinner in Delmonico's downtown restaurant, New York.

Dewey C. Bailey, Jr., of the firm of Frueauff, Robinson & Sloan; H. D. Williams of Buffalo and Leslie

BIRTHDAY DINNER TO H. L. DOHERTY

M. Shaw, former Secretary of the Treasury, paid tributes to the guest of the evening. Frank W. Frueauff was toastmaster. Peter D. Vroom, editor *Doherty News*, read a birthday ode, "When Time Wins Out."

OKLAHOMA MUNICIPAL ELECTRIC AND WATER PLANTS

Investigation by H. V. Bozell Shows That Twenty-two of Twenty-four Publicly Owned Combination Electric and Water Plants Showed Deficit

A report of an investigation of the principal municipally owned combination electric and water plants in Oklahoma shows that twenty-two out of twenty-four such enterprises finished the fiscal year ended June 30, 1914, with a deficit. The investigation was made by H. V. Bozell, director of the School of Electrical Engineering at the University of Oklahoma. The following summary of Mr. Bozell's findings is based on exhibits making provision for depreciation and interest on investment, but not including sinking-fund reserves:

City	Deficit	†Cents per Kw.-Hr.	City	Deficit	†Cents per Kw.-Hr.
Blackwell	$9,530	10	Perry	$9,889	15
Cherokee	*320	12½	Ponca City	15,715	10
Claremore	6,809	10	Purcell	9,041	15
Clinton	3,087	14	Sallisaw	12,273	15
Cordell	1,693	16	Sayre	4,548	15
Edmond	8,526	12½	Snyder	11,870	15
Fairview	17,424	12	Stillwater	*1,474	10
Kingfisher	5,106	10	Tonkawa	7,081	10
Marlow	5,162	12	Wagoner	24,604	Flat
Newkirk	9,043	10	Weatherford	5,709	10
Pawhuska	8,373	10	Woodward	6,793	10
Pawnee	1,998	10	Wynnewood	2,585	15

*Surplus. †Electric base rate.

Selling the Liberty Loan

Plans of Various Companies in the Electrical Industries to Help the Government Float the Bonds—Aggregate Subscription Enormous

FRANK A. VANDERLIP, president National City Bank of New York, listed in last week's issue of the ELECTRICAL WORLD four ways in which electrical companies can assist in placing the Liberty Loan, in substance as follows:

By subscribing themselves; by making it easy for employees to subscribe; by sending inclosures with all bills and notices; by giving facilities gratuitously to the local advertising committees.

In all of these ways electrical companies are giving service. Reports to the ELECTRICAL WORLD show that the response of the companies to the patriotic call is general and that there will be an enormous subscription from the different elements of the great electrical industries.

Among the subscriptions and plans, in addition to some mentioned in previous issues, are the following:

ARRANGEMENTS OF GENERAL ELECTRIC COMPANY

As stated in last week's issue of the ELECTRICAL WORLD, the General Electric Company has set aside $5,000,000 for the purchase of Liberty Loan bonds.

In addition to this investment, as a means of assisting the Liberty Loan, the company will purchase Liberty Loan bonds for its 79,000 employees on subscription, in all denominations, to any amount, and give the subscribers extended time in which to pay for them. The company will pay for its employees' subscription bonds as required by the government and will permit the subscribers to pay for them on the installment plan as follows: $50 bond, $1 per week; $100 bond, $2 per week; $500 bond, $10 per week; $1,000 bond, $20 per week; or by monthly payments of 10 per cent of subscription each month.

COMMONWEALTH EDISON COMPANY'S PLAN

The Commonwealth Edison Company of Chicago has bought $1,500,000 of the Liberty Loan bonds. It will offer bonds to employees on terms even more liberal than those allowed by the government. The bonds purchased from the company may be paid for under any of three plans:

Under plan No. 1 the employee will pay for any bond subscribed for by him in full on or before July 15, 1917, and the company will deliver to the employee the bond or bonds as soon as practicable after the payment of the par amount and interest thereon at the rate of 3½ per cent per annum from June 15, 1917, to the date of payment.

Under plan No. 2 the employee will pay for any bond subscribed for by him upon practically the same terms as those allowed by the government to persons subscribing for bonds directly and paying for them in installments—that is, 2 per cent on the date upon which the employee subscribes, which must be on or before June 15, 1917; 18 per cent on June 28, 1917; 20 per cent on July 30, 1917; 30 per cent on Aug. 15, 1917, and 30 per cent on Aug. 30, 1917. No bond or bonds will be delivered to the employee subscribing until the bond is fully paid for, and upon delivery of the bond an adjustment of interest will be made so that the employee will receive the same interest as he would receive if the bond were purchased directly from the government on the installment plan.

Under plan No. 3 the employee will pay for any bond subscribed for by him in installments as follows: 20 per cent on July 2, 1917, and 10 per cent on the first day of each of the next succeeding eight months, and the employee will receive interest upon all installments so paid at the rate of 3½ per cent per annum from the date of payment.

TO THE EMPLOYEES OF THE COMPANY:

¶ Some time ago the Company addressed a communication to its employees, urging them to subscribe to the "Liberty Loan" of the United States Government, but at that time the exact terms of the loan had not been fixed. Now that all the details of the loan are known it seems desirable to supplement what was said in the former communication by a more definite statement.

¶ The bonds, payable to bearer and with interest coupons attached, will be issued in denominations of $50, $100, $500 and $1,000, will be dated June 15, 1917, and will bear interest at the rate of 3½ per centum per annum from that date, payable semi-annually on December 15 and June 15.

The bonds will mature June 15, 1947, but may be redeemed at the option of the Government on or after June 15, 1932, in whole or in part, at par and accrued interest. The bonds will contain provisions permitting them to be exchanged, par for par and without cost to the holders thereof, for any other bonds which the United States may subsequently issue during the present war bearing a higher rate of interest, and the bonds will be exempt, both as to principal and interest, from all taxation excepting inheritance taxation.

¶ Altogether the bonds are very attractive and, of course, an investment in them is the safest investment that can be made. Moreover, it is the patriotic duty of every citizen of the United States to share in the loan by purchasing as large an amount of these bonds as he is able to purchase.

¶ The Government, in issuing the bonds in denominations as low as $50, has made it possible for every employee of the Company to take at least one bond.

¶ Feeling confident that all its employees will want to do their full share in supporting the Government by purchasing as many bonds as possible, and desiring to lighten their burden as much as possible, the Company has decided to buy a large amount of the bonds outright and sell them to employees on terms even more liberal than those allowed by the Government. Bonds purchased from the Company may be paid for under three plans, which are fully explained on page 3 of this circular. An employee purchasing a $50 bond under Plan No. 3 is required to pay $10 on July 2 and $5.00 on the first of each of the following eight months, and on all payments the employee is allowed interest at the rate of 3½ per centum per annum.

¶ Every employee of the Company is requested to read this circular carefully and do all that he feels he can afford to do in purchasing bonds.

¶ The Company will be glad to give employees any further information that they may desire.

¶ Each employee is requested to return to the Company, without delay, a subscription for the amount of bonds desired. A form of subscription follows the statement of each of the three plans on page 3 of this circular. If the employee desires to subscribe, for example, under Plan No. 3, he should sign the form of subscription following the Statement of Plan No. 3 and return it to the officer of the Company to whom the subscription is addressed.

¶ *In order to insure their acceptance by the Company, the signed subscriptions of employees should be in the hands of the Company before noon on June 15, 1917.*

COMMONWEALTH EDISON COMPANY.

Samuel Insull

President.

PLAN OF WESTINGHOUSE COMPANY

E. M. Herr, president Westinghouse Electric & Manufacturing Company, in a letter to the company's employees says:

"Every employee making a subscription to the Liberty Loan will not only secure a safe investment, but will perform a patriotic duty. It is the savings from to-day on that are going to supply the funds for the war because the savings of the past have already been invested, and if you are willing to save a small amount

each week and invest it in these Liberty bonds you will help at the source, which will be the most effective kind of financial assistance that can be given."

The terms of payment to employees will be as follows: For those who are paid semi-monthly 5 per cent of the face of the subscription will be taken from each regular pay, beginning with the last pay made in June. This will mean 10 per cent per month. For those who are paid only at the end of each month 10 per cent per month, beginning with the pay at the end of June. Adjustment of accrued interest at 3½ per cent will be made at time of final payment.

The Westinghouse Electric & Manufacturing Company has subscribed to $2,500,000 of the bonds.

Plan of Doherty Organization

Provisions have been made by Henry L. Doherty & Company whereby subscriptions of $20 can be made and receipts issued for this amount. Subscription may be made on the following bases:

Class 1 may pay immediately for their total subscriptions by having full payment accompany subscriptions. Bonds will be delivered to subscribers of this class as soon as issued by the government.

Class 2 may pay for their subscriptions by cash remittances on the dates stated by the government, which are as follows: 2 per cent June 15, 1917 (deposited when subscribing); 18 per cent June 28, 1917; 20 per cent July 30, 1917; 30 per cent Aug. 15, 1917; 30 per cent Aug. 30, 1917.

Class 3.—To enable employees to purchase amounts of United States Liberty bonds without imposing undue burdens upon themselves, Henry L. Doherty & Company have made arrangements that permit the purchaser to pay for bonds by the following installment method: Payments can be made in ten monthly or forty weekly installments, beginning June 15, through the payroll department or by check. Interest coupons as received will be credited to the account. Interest at the rate of 3½ per cent per annum will be charged monthly on unpaid balances. Payments may be made at a more rapid rate if the purchaser so desires.

New York Companies

Two hundred and fifty officials and department heads of companies of New York and vicinity held an enthusiastic meeting in the auditorium of the Consolidated Gas building on May 28 to inaugurate a campaign among employees on the Liberty bond. The companies were: Consolidated Gas Company, New Amsterdam Gas Company, New York Mutual Gas Company, Standard Gas Light Company, New York Edison Company, United Electric Light & Power Company, Westchester Lighting Company, Northern Westchester Lighting Company, New York & Queens Electric Light & Power Company, Peekskill Railway & Lighting Company, Yonkers Electric Light & Power Company, Municipal Lighting Company, and National Coke & Coal Company.

R. A. Carter, a member of the Liberty Loan committee, is chairman of the new committee, and F. W. Smith, vice-president United Electric Light & Power Company, is chairman of the sub-committee on promotion.

The plan enables the employee to purchase the bond on a deferred payment basis, $1 each week being deducted from his wages for each fifty-dollar bond purchased. If paid monthly, twelve monthly payments are made.

Edison Companies

Thomas A. Edison, in a statement to the Liberty Loan committee in New York, said:

"Pay what it's worth to you to be an American citizen. Figure it cold-bloodedly—if you are built that way. Consider what this country has meant to you, what it will mean to your children and to humanity in future generations. Then when you have thought over these things take pen in hand and do your bit for the Liberty Loan.

"From the highest to the lowest the uppermost idea should be how we can serve our common country. Some of us are going to make the supreme sacrifice of our lives on the battlefields of France and on the high seas. Some of us are working night and day to solve the scientific questions involved in conquering our German foes. Some of us are expected to do our bit on the farms or in the factories. There is a niche for almost all of us if we will but look for it with patriotic eyes."

Mr. Edison telegraphed to President Wilson that 200 clerks and workmen, organized by a German-American, had subscribed $30,000 to the loan and pledged themselves to raise $300,000 among their fellow-workmen in the Edison laboratories.

Liberty Bonds in New England

New England electrical interests are actively supporting the purchase of Liberty bonds. The Cumberland County Power & Light Company, Portland, Me., has put in effect a plan under which these bonds may be secured by installment payments at rates below the government installment schedule. The company advances money at 5 per cent interest and allows the employee to pay for the bonds in small monthly installments as follows:

Initial payments upon subscription of $5, and eleven installments to be paid the first day of every month beginning July 1, 1917, of $4.12 each on a fifty-dollar bond.

These amounts are based on 5 per cent interest on the balances, less the Dec. 15, 1917, coupon for 87 cents, which is retained as part of the interest. Under this plan the bond becomes the property of the employee upon payment of the last installment, due May 1, 1918.

Employees of the Pittsfield (Mass.) works of the General Electric Company subscribed to a larger amount of these bonds than any other concern in the city on a recent Liberty Loan day, and every one of the 250 employees of the Boston office of the company has subscribed to the issue.

Other Subscriptions Reported

Niagara Power Company, $1,500,000.

Public Service Company of Northern Illinois, $250,000.

Middle West Utilities Company, $100,000.

Western Union Telegraph Company, $2,500,000.

The Mutual Investment Credit Union of the Postal Telegraph Company has arranged to purchase bonds for employees, to be paid for in installments.

Montana Power Company, $500,000.

McGraw-Hill Publishing Company, Inc., publisher of the ELECTRICAL WORLD, $100,000.

Consolidated Gas, Electric Light & Power Company, Baltimore, $100,000, to be followed by another substantial subscription on behalf of employees.

REDUCED ELECTRICAL RATES IN PORTLAND, ORE.

Public Service Commission of Oregon Orders New Schedule, Although "Fair Return" on the Investment Is Not Being Earned

In a decision handed down on May 21, the Public Service Commission of Oregon ordered a reduction in the light and power rates of the Portland Railway, Light & Power Company.

This decision came as a result of a succession of investigations, valuations and hearings that have been held during several years past. The reduction on domestic lighting will amount to between 10 and 15 per cent, or from $60,000 to $65,000 a year, according to estimates made by the commission. If the Northwestern Electric Company, a competitive concern, meets the new rates, another $10,000 or $12,000 a year will be cut off from the domestic service charges in Portland.

The Portland Railway, Light & Power Company has announced publicly that it will accept the rates, although it is thought that they will work some hardship on the company. It is not yet apparent that the order applies to the rates of the Northwestern Electric Company.

As a general proposition, the commission decided that while the company at present was not earning a fair return on its investment, it felt that the main reason for this was the competitive condition that existed and, inasmuch as the Portland company was not meeting its competitor's rates, it could not put forward the excuse that it was not getting a fair return.

The total valuation of the property furnishing electrical energy owned by the utility as found by the commission amounts to $18,866,985, and during the last four and one-half years the return from utility operations has been 5.27 per cent. The average return for the last one and one-half years has been 4.16 per cent. The commission specifically states that this return is below that generally expected and received by investors in the Pacific Northwest.

The present lighting rate of the Portland Railway Company provides for a charge of 9 cents per kilowatt-hour on the first 6 per cent used of the monthly maximum consumption; 7 cents per kilowatt-hour is charged on the next 6 per cent used of the monthly maximum consumption, and 4 cents for all over that. As a general rule the number of kilowatt-hours used on the primary and secondary steps amounts to 10 or 15 for each step.

The new rates are as follows:

RESIDENCE LIGHTING

First 20 kw.-hr. per month for first 600 watts or less of installation, plus 1 kw.-hr. per month for each additional 30 watts of installation (in excess of 600) will be at the primary rate.

All consumption in excess of that at the primary rate will be at the secondary rate.

Primary rate—First 13 kw.-hr. or less, $1; excess over 13 kw.-hr., per kilowatt-hour, 7 cents.

Secondary rate—First 50 kw.-hr., 3 cents per kilowatt-hour; excess over 50 kw.-hr., 2 cents per kilowatt-hour.

Discount of 5 per cent will be given for payment within ten days from the date of the bill.

Minimum bill for lighting service, $1 per month; minimum bill for lighting service, in combination with heating, cooking and small domestic power loads having a possible connected capacity in excess of 2 kw., $2 per month.

Lighting equipment in excess of 1 watt per square foot of floor area in any room will not be considered in determining the size of the installation.

No heating, cooking or power appliances will be considered in the determination of installation in the lighting rate.

COMMERCIAL POWER

First seventy-three hours' use per month of the consumer's demand will be at the primary rate. All consumption in excess of that at the primary rate will be at the secondary rate.

Primary rate—First 500 kw.hr., 5 cents per kilowatt-hour; next 500 kw.-hr., 4 cents per kilowatt-hour; next 4000 kw.-hr., 3 cents per kilowatt-hour; excess over 5000 kw.-hr., 2 cents per kilowatt-hour.

Secondary rate—For installations with a demand of 10 kw. or less—First 1000 kw.-hr., 2.0 cents per kilowatt-hour; excess over 1000 kw.-hr., 1.25 cents per kilowatt-hour.

For installations with a demand of from 10 to 20 kw.—First 2000 kw.hr., 1.75 cents per kilowatt-hour; excess over 2000 kw.-hr., 1 cent per kilowatt-hour.

For installations with a demand of from 20 to 35 kw.—First 3000 kw.hr., 1.5 cents per kilowatt-hour; excess over 3000 kw.-hr., 0.9 cent per kilowatt-hour.

For installations with a demand of from 35 to 50 kw.—First 6000 kw.-hr., 1.25 cents per kilowatt-hour; excess over 6000 kw.-hr., 0.8 cent per kilowatt-hour.

For installations with a demand of from 50 to 100 kw.—First 9000 kw.-hr., 1 cent per kilowatt-hour; excess over 9000 kw.-hr., 0.8 cent per kilowatt-hour.

For installations with a demand of over 100 kw.—First 10,000 kw.-hr., 1 cent per kilowatt-hour; next 20,000 kw.-hr., 0.8 cent per kilowatt-hour; next 40,000 kw.-hr., 0.7 cent per kilowatt-hour; next 80,000 kw.-hr., 0.6 cent per kilowatt-hour; excess over 150,000 kw.-hr., 0.5 cent per kilowatt-hour.

Minimum charge—$1 per month per kilowatt of demand; no minimum less than $1 per month.

Any consumer operating under a secondary rate schedule with demand limits higher than his actual demand, shall pay a minimum bill indicated by the lowest demand provided in that schedule.

When the demand of any consumer is determined monthly, the minimum bill shall be based upon the kilowatts of service capacity contracted for by the consumer.

APPLICATION OF SECONDARY RATE

At the time of contract the consumer shall be placed upon that secondary rate which his load conditions indicate as the most economical. If, at the end of a period of twelve consecutive months of service thereafter, or a shorter period caused by the termination of a contract, it is found that a lower total charge for the period could have been obtained under any other secondary rate, the consumer shall be credited with the amount of the difference and shall be entitled to continue service under the more advantageous rate, subject to similar correction at the end of each succeeding period of twelve consecutive months of service thereafter, or after a shorter period caused by the termination of his contract.

As far as the power rates are concerned, they are substantially the same as the company now charges, and it is not believed that a material reduction in earnings will result.

The commission has criticised the company for certain practices in reference to combining light and power business on power schedules, and this will be investigated more extensively by the commission. Another subject of criticism was the application of wholesale rates to apartment house managers who in turn retail to their tenants, and in addition to the wholesale rate a further discount of 10 per cent has been given to the apartment house managers. The commission contended that the allowances to apartment house managers were too large and that if a wholesale rate was given the additional 10 per cent was not justified. This matter, it is understood, will be investigated by the commission as well as the question of adjusting commercial lighting rates.

FACTORY COST COMPARED WITH ELECTRIC LIGHTING

Interesting Conclusions in Discussion of Ward Harrison Before Chicago Section, Illuminating Engineering Society

BY J. R. CRAVATH

At the last meeting of the Chicago Section, Illuminating Engineering Society, Ward Harrison of Cleveland gave figures on factory lighting and modern possibilities in that line which should furnish food for thought to all owners of growing industrial plants and illuminating men as well.

A number of typical Cleveland factories were investigated and it was found that the daylight illumination values were surprisingly low at the actual points of work as compared with the values which can be obtained very near windows, which latter are often quoted as daylight values. While values of several hundred foot-candles were common very near windows, the measurements taken by Mr. Harrison and his associates at actual points of work showed that in the main the intensities were from 1 to 20 foot-candles, the average of the minimum and maximum values being 4 and 18 respectively. Now with light flux produced as cheaply as it is with modern lamps, artificial illumination of the same order of intensities as such daylight can be produced at a very reasonable expense. In some respects this artificial illumination could be made superior to daylight because it could be distributed so much more uniformly. As to diffusion and freedom from glare it would be somewhat inferior. Averaging advantages and disadvantages it would compare very favorably with daylight.

OPERATING FACTORY WITH TWO SHIFTS

Mr. Harrison then brought up the old question of the relative economy of operating a given factory with two shifts as against a factory of double the size with one shift, daytime only. However, he introduced into the problem the new elements made possible by the modern development of the lighting art. It has been general practice in the past, when the output of a manufacturing plant was to be increased permanently, to increase the buildings, machinery and equipment rather than to work the same equipment more hours per day. The reason for this has been prejudice against night work and the general experience that night-shift laborers do not turn out as much work as those on day shift, presumably because artificial lighting has not been as good as daylight and because restful sleep is more difficult to obtain in daytime than at night. As far as the factory lighting is concerned it is not difficult to show that conditions can be made as good as by daylight.

Figures prepared by Mr. Harrison on the rental value of factory and equipment for increasing the capacity of a factory, as against increasing the output by night work, showed that the cost of lighting with off-peak electrical energy, with modern lamps and costs of production, would be considerably less than the rent or fixed charges on additional factory space and equipment for a factory about to enlarge its output. The old argument that lighting at night is not so good as by day was made necessary by old costs of light and no longer holds.

The objection of difficulty of sleeping in the daytime is then the principal argument left. As to this Mr. Harrison offers the suggestion that the entire night is not now used for sleeping by the average man, and that by an entire rearrangement of hours of work and recreation both shifts of operators in a factory operating two shifts might have nearly as many of the hours of darkness for sleeping purposes as are now enjoyed, and some of the hours of recreation and amusement would be changed so as to throw them more into daylight and also afford a better load factor for places of amusement and recreation as well as for the factory equipment.

ANNUAL CONVENTION OF OKLAHOMA ASSOCIATION

Value of and Necessity for Publicity and Education of the Public in Utility Problems Is Recognized

The sixth annual convention of the Oklahoma Gas, Electric & Street Railway Association was held at the Lee Huckins Hotel, Oklahoma City, Okla., on May 10, 11 and 12.

President C. H. Kretz called attention in his annual address to the value of and necessity for publicity and education of the public in utility conditions.

A. R. Sanson, in his paper on "Small-Plant Troubles," enumerated the many operating and public policy problems incident to small-plant operation. One great source of annoyance mentioned was poor wiring of houses in the small towns, forcing the utility to operate a house-wiring department. He also mentioned the difficulties of small utilities in keeping records required by the Corporation Commission. Good accountants are required and cannot be obtained at the salaries the small plants can afford.

Discussion brought out the fact that some small plants eliminated defective house wiring through incompetent men by having a wiring firm in a larger city do the work.

D. E. Nims, Oklahoma Gas & Electric Company, in his paper on "Industrial Power," advocated talking from the standpoint of so much per unit product of the factory and not in kilowatt-hours, maximum demand etc. He told of securing business by solving problems of manufacturers.

On Friday morning, May 11, W. B. Clayton, General Electric Company, made an address on "Meters and Meter Testing." One town was losing $144 a month from slow meters in the business section alone. He said that 95 per cent of installed meters will run slow and not fast after a few years' service, and that the expense of buying test equipment will be more than recouped through increased revenue.

Corporation Commissioner Campbell Russell made an address in the afternoon on "Protection of the Utilities in Their Legitimate Investments and Business." He said that speculation had no place in a public utility, and that the commission was for the protection of the utility as well as the public.

J. W. Shartel in the discussion brought out points in which the utilities should be protected. They should not be required to file so many reports containing the same material with so many regulating bodies.

At the annual banquet on Friday evening J. W. Shartel was toastmaster. Talks were made by several

managers on the value of organization and education for public utilities.

On Saturday morning, May 12, Prof. L. C. Lichty read a paper on the "Burning of Coal Under Boilers," and brought out the fact that the United States Bureau of Mines had found that for complete combustion of coal the same amount of air must be put on top of the fuel bed as is forced through the grates.

E. W. Pembleton read a paper on the extraction of gasoline from natural gas and its effect on the B.t.u. content.

The following officers were elected: President, F. D. Shaffer, Chickasha Gas & Electric Company; first vice-president, J. F. Owens, Muskogee Gas & Electric Company; second vice-president, W. H. Vorce, Choctaw Light & Power Company, McAlester; secretary-treasurer, Prof. L. W. W. Morrow, University of Oklahoma, Norman. Directors: F. W. Insull, Public Service Company, Tulsa; R. K. Johnson, Washita Electric Company, Pauls Valley; C. H. Kretz, Okmulgee Ice & Light Company; R. E. Whitenack, Kingfisher light and water plant.

ARKANSAS UTILITY OPERATORS HOLD TENTH CONVENTION

Attendance at Pine Bluff Meeting Larger than at Past Conventions—S. E. Dillon the New President

The tenth annual convention of the Arkansas Association of Public Utility Operators was held at the Hotel Pines, Pine Bluff, Ark., on May 16-18. The attendance surpassed all past conventions in the number of companies represented, thirty-five public utility plants in the State having delegates at the meeting.

The following papers were read: "Commercial Efficiency," by P. T. Phillips, Little Rock Railway & Electric Company, Little Rock, Ark.; "The Electric Range and Its Advantages for Increasing the Central Station Load," by C. A. Meier, Westinghouse Electric & Manufacturing Company, St. Louis, Mo.; "The Application of Electric Drive to Arkansas' Chief Industries," by E. W. Smith, General Electric Company, St. Louis, Mo.; "The Increase of Taxes on Corporations," by S. E. Dillon, Citizens' Electric Company, Hot Springs, Ark.; "Relations of the Jobber to the Central Station," by L. S. Hunt, Commercial Electric Supply Company, St. Louis, Mo.; "Alternating-Current Motors," by Lee B. Roseborough, Wagner Electric Manufacturing Company, St. Louis, Mo., and "Lightning Arresters as Applied to 2300-Volt Distribution Systems," by J. L. Longino, Arkansas Light & Power Company, Arkadelphia, Ark.

The officers elected for the new year are: President, S. E. Dillon, general manager Citizens' Electric Company, Hot Springs, Ark.; first vice-president, E. T. Reynolds, manager Arkansas Light & Power Company, Paragould, Ark.; second vice-president, P. T. Phillips, engineer Little Rock Railway & Electric Company, Little Rock, Ark.; secretary-treasurer, R. B. Fowles, auditor the Pine Bluff Company, Pine Bluff, Ark.

The next meeting will be held in Hot Springs, Ark., in 1918 at a date to be selected by the executive committee. Dean W. N. Gladson of the electrical department of the University of Arkansas was elected to honorary membership.

WESTINGHOUSE COMPANY DOES A LARGE BUSINESS

Value of Unfilled Orders for Regular Products of the Company on March 31, 1917, Increased 80 Per Cent Over Last Year

Sales billed and net income of the Westinghouse Electric & Manufacturing Company in the fiscal year ended March 31, 1917, were greatly in excess of any previous year in the history of the company. Sales billed amounted to $89,539,442, as compared with $50,269,240 in the preceding year, an increase of $39,270,202, or 78.1 per cent.

The value of unfilled orders on March 31, 1917, for the regular products of the company was $39,776,739, as compared with $22,097,995 on the same date last year, a gain of $17,678,744, or 80 per cent.

Report of Chairman Tripp

In the annual report to stockholders Guy E. Tripp, chairman board of directors, said in part:

"The completion of large orders for munitions contributed largely to the results for the year, although sales billed and net income for the regular products of your company show large increases over any preceding year.

"The amount of taxes, federal, state and county, paid or accrued during the year is in excess of $2,000,000.

"Owing to a strike of the employees the main works of the company at East Pittsburgh were closed from April 21, 1916, to May 16, 1916.

"The net income for the year, $18,079,889, increased the surplus of $9,246,707 as of March 31, 1916, to a gross surplus of $27,326,596.

"Dividends were declared for the full year at 7 per cent per annum upon the preferred stock and upon the common stock at the rate of 6 per cent per annum for the first and second quarters and at 7 per cent per annum for the third and fourth quarters.

"For the purpose of increasing the reserve account $5,000,000 has been appropriated from surplus.

"The net surplus as of March 31, 1917, is $18,105,298, as compared with $9,246,707 on March 31, 1916.

"The property and plant account shows a net increase during the year of $1,499,805. This increase is almost wholly accounted for by expenditures for real estate and buildings and equipment of a factory at Milwaukee for the manufacture of incandescent lamps, real estate at Trenton, N. J., for another lamp factory, and real estate at Essington, near Philadelphia, Pa., for a large extension of your general manufacturing facilities. This latter tract of land comprises approximately 500 acres, and the erection of buildings on the site is now in progress.

"Depreciations of buildings and equipment and expenditures for extensions, renewals and betterments of plant and equipment were written off to the amount of $6,473,066.

"Investments in other companies increased $2,493,825, which chiefly represents additional shares of the Electric Properties Corporation and Canadian Westinghouse Company acquired during the year.

"The current and working assets, viz., cash, accounts and notes receivable and inventories, reflect unusual increases due to the greatly increased volume of business completed during the year and orders in hand.

"In addition to current collections the item of ac-

counts receivable will be reduced by a cash payment of more than $11,000,000 from the British government on account of munitions, which will be due on or before July 10 next.

"By the sale in February, 1917, of $15,000,000 additional common stock and the conversion of more than $3,000,000 bonds, the total outstanding stock was increased during the year to $74,812,650. The balance, $2,247,000, of the convertible sinking fund 5 per cent bonds issued in 1915, outstanding on Oct. 1, 1916, were called for redemption on Jan. 1, 1917. All but $71,000 face value of these bonds were converted into common stock before the redemption date.

"Your company has outstanding bank loans to the extent of $15,100,000. These loans were made necessary by the large amount of capital invested in working and current assets, including the amount due from the British government, reference to which has been made above, and the maintenance of a large cash balance in excess of $12,000,000.

"This report does not include the operations of the Westinghouse Machine Company nor are the assets and liabilities of that company included in the balance sheet. By the acquisition during the year of additional shares of stock of the machine company, your company now owns more than 98 per cent of the outstanding share capital of that company. A plan for the merger of the machine company with the Westinghouse Electric & Manufacturing Company is now under consideration.

MUNITIONS ORDERS

"In the manufacture of Russian rifles for the British government, the New England Westinghouse Company encountered serious delays and difficulties, through various causes, most of them beyond its control or responsibility. In October, 1916, the Anglo-Russian Commission located in New York recognized the company's claim for extensions of the original dates of delivery and approved an arrangement based on the new dates proposed by the company. Early in the present year, however, the New England company was advised that this arrangement could not be consummated and that a new arrangement was desired. As the result of further negotiations a modified agreement has now been made under which the initial order has been reduced to 1,000,000 rifles at an increased price per rifle and the time of delivery materially extended. The British government is, however, given an option to increase the number of rifles to the original number, viz., 1,800,000, in which case the original price is to be reinstated.

"The new contract also provides that the British government shares equally with the New England company in all profits and also guarantees your company and the New England company against any loss exceeding $5,000,000 in any contingency whatever under this contract or as the result of the investment in connection therewith. In view of the unusually prosperous year just closed, your directors have thought it a conservative policy to set aside this amount in a special reserve. As this amount is included in the advances already made the New England Westinghouse Company, and as the British government will advance all needed funds hereafter, there will be no further drafts upon the cash resources of your company on account of the rifle contract.

"With the exception of the contracts with the British government for the manufacture of Russian military rifles, which are being carried out by the New England Westinghouse Company under a modified contract hereinbefore referred to, the company has no uncompleted munitions contracts for foreign governments on its books, all such contracts having been completed or canceled.

"The large increase in the volume of business done during the year called for unusual effort on the part of the officers and employees of your company, and the board of directors has pleasure in acknowledging the enthusiastic service and co-operation that made possible the satisfactory results obtained."

Earnings for three years compare as follows:

Year Ended March 31	1917	1916	1915
Gross earnings—sales billed	$89,539,442	$50,269,240	$33,671,485
Cost of sales—cost of manufacture, including depreciations of property and plant and all selling, administration and general expenses and all taxes	72,077,752	40,839,344	31,109,073
Net manufacturing profit	$17,461,690	$9,429,896	$2,562,412
Other income	1,386,547	1,106,730	1,158,527
Gross income from all sources	$18,848,237	$10,536,626	$3,720,939
Less—inventory adjustments, inactive apparatus and material scrapped, bad accounts and extraordinary items of expense charged to income	*	*	442,277
Net income applicable to interest and other charges	$18,848,237	$10,536,626	$3,278,662
Interest charges	768,348	869,837	1,268,918
Net income available for dividends and other purposes	$18,079,889	$9,666,789	$2,009,744

*Included in cost of sales.

ELECTRIC VEHICLE SECTION MEETING IN CHICAGO

Announcement of Commonwealth Edison Garage Plan and Results of Successful Parking Arrangement Shown—D. M. Simpson Elected Chairman

The feature of the annual meeting of the Chicago Electric Vehicle Section of the National Electric Light Association was the announcement by E. W. Lloyd, general contract agent Commonwealth Edison Company, of the electric-truck garage plan reported on page 1080 of this issue.

W. P. Kennedy, consulting engineer, New York, in speaking of the plan said the impression is abroad that motor trucks have superseded many more horses than they actually have displaced. Only 2 to 3 per cent fewer horses are in use by Chicago trucking interests to-day than there were several years ago. It is true that the increase in business has been taken care of largely by motor trucks, but there are still in the city between 60,000 and 70,000 horses, which might better be replaced by electric vehicles. The time to enter upon such a garage venture is particularly opportune since experience shows that the war has increased electric vehicle business in England 500 per cent. Mr. Kennedy said that he considered the opportunity before manufacturers of industrial electric trucks and tractors to be almost without parallel in the history of any business.

George B. Foster, retiring chairman of the section, spoke highly of the work of committees and praised particularly the results obtained under the electric vehicle parking service. This service handled 3235 cars in 1916, and thus far in 1917 the total is 1221; there

have been practically no accidents worth mention. The average operating expense in connection with the service, which is borne by association members interested, is $72.86 a month.

These officers were elected for the ensuing year: Chairman, D. M. Simpson, General Lead Batteries Company; vice-chairman, W. F. Bauer, Edison Storage Battery Company; secretary, L. C. Spake, ELECTRICAL WORLD.

CHICAGO SERVICE PLAN FOR ELECTRIC PASSENGER CARS

Garage Man Offers Unlimited Mileage Arrangement with New Electric Vehicles—Advantages for the Customer

Harry Salvat of the Fashion Automobile Station, Inc., Chicago, agent for the Milburn electric car, has developed a battery rental and exchange plan in connection with the sale of new cars. This was announced almost simultaneously with the Commonwealth Edison Company's trucking-service plan, but there is no direct relation between them.

Under the Fashion garage plan the Milburn car,

Important
Notice
Here is the most important announcement ever made in the electric car field.
You can enjoy uninterrupted mileage service in a
Milburn Light Electric
by means of the new Exchange Power System.
This is an exclusive Milburn feature.
No more delays for recharging.
Drive your Milburn as far as you like.
Our service stations in various parts of the city will furnish you with new power quicker than you can refill a gasoline tank.
You are on your way again in a jiffy and pay only for the power you use.
Fashion Automobile Station, Inc.
Distributors, Chicago, Ill.
Corner 51st Street and Cottage Grove Avenue
Demonstration and catalog without obligation. Write us, or phone Oakland 1516
The Milburn Light Electric is manufactured and guaranteed by the Milburn Wagon Company of Toledo, Ohio—seventy years of successful manufacturing.

ANNOUNCEMENT OF BATTERY PLAN FOR ELECTRIC CARS

minus the battery, is sold for $1,485. The battery for the car is rented for $15 a month plus $1 per battery change. The cars are equipped with a specially designed battery rack so that the battery may be changed in two and five-tenths minutes, or in less time than it takes to fill a gasoline tank. Changes can be made at any of five stations strategically located in Chicago and its suburbs.

This plan supplies the user with unlimited mileage from a standard battery; it relieves him of investment in a battery; it assures him that his battery will always be under expert care and, should he be out of the city, it permits him to eliminate battery costs and depreciation during periods longer than one month.

ELECTRIC TRUCK SERVICE OF COMMONWEALTH EDISON

Chicago Company Inaugurating a System for Garaging, Charging and Completely Maintaining Electric Trucks on an Annual Contract Basis

The Commonwealth Edison Company, Chicago, has decided to offer complete garage and maintenance service for commercial electric vehicles at specific rates per annum on long-term contracts. This service will be so comprehensive as to cover all the doubtful elements of transportation expense, and will enable a customer to determine all operating costs in advance.

The service will cover first the ordinary garaging or storage charges, including cleaning and care of vehicles. Second, it will include energy for battery charging. It will provide for maintenance or upkeep of the wearing parts of the vehicle, including tires, battery and mechanical parts. "Maintenance" will also cover minor repairs, painting the body at specified intervals, retouching and varnishing at intermediate times. The owner will pay the driver's wages, insurance and the cost of damage by accident.

Only new trucks will be accepted for the service. The rate for each size, equipped with standard battery, will be a flat figure per annum, payable monthly in equal amounts. Trucks equipped with batteries of sizes larger than standard will be charged for at proportionally higher rates. The working radius of the truck which the flat rate is intended to cover is that amount of service which can be procured from one charge of the battery daily. If the work to be done should be greater than this and should require additional charging during the day, or the use of extra batteries, the flat rate will be increased accordingly. Thus the whole system, while based on a flat rate for minimum service, is really a measured-service scheme, depending upon requirements of the user.

The Commonwealth Edison Company is having a large service station erected at Jackson Boulevard and Morgan Street, close to the trucking center just west of the "loop" district. This station should be ready by the end of the summer, and it will render service to 100 electric trucks. Should this space be taken up quickly, additional space will be provided in the same neighborhood for a further trial of the proposed service. The company is planning to establish other stations as the project develops, beginning with one on the north side and one on the south side of the "loop" district, if the first undertaking demonstrates a satisfactory demand for this type of service.

The company will employ a specially qualified staff to develop and conduct this service. Salesmen, supplemented by the service of transportation engineers, will be able to present to prospective customers having large horse-truck equipment facts and figures which will fully satisfy them as to their present expense, and will present subsequent statements which will prove the reduced expense to be effected by substituting electric trucks.

Considerable research work has been done to determine size, location and other characteristics concerning the principal horse-truck equipment now in Chicago. By an intensive campaign the company will be able to show local truck owners how to purchase electric trucks from the manufacturer and operate them at a saving over present equipment.

DISTRIBUTION OF NIAGARA, LOCKPORT & ONTARIO POWER

Company Sells 47 Per Cent to Distributing Properties, 30 Per Cent to Industrials and 23 Per Cent to Railways

Distribution of the power sales among different classes of consumers is shown by the annual report of the Niagara, Lockport & Ontario Power Company for 1916. Reaching a present population of 1,400,000 in a rapidly growing territory, the sales of the company were distributed:

To corporations distributing electricity in Oswego, Syracuse, Rochester, Auburn, Geneva, Batavia, Lockport and numerous smaller municipalities and municipal lighting plants, 47 per cent.

To industrial companies, 30 per cent.

To electric railways operating 1100 miles of track in cities and suburban sections of western and central New York, 23 per cent.

Fred D. Corey, the president, says in the report:

"Having in mind the desirability of a well-balanced power supply, the directors have from time to time by purchase or lease added to the company's sources of supply. At present the power sold comes from four different generating stations, all operating in parallel and located at widely separated points within or adjacent to the territory served by the companies.

PACIFIC GAS & ELECTRIC TO DEVELOP PIT RIVER POWER

Five-Year Construction Program, Involving $17,500,000 and 180,000 Hp., to Be Handled by Large Company

The Pacific Gas & Electric Company announces that it will take over at once construction work on the Big Bend project on Pit River, developing rights secured recently from the Mount Shasta Power Corporation. The power house site is about 60 miles (96.6 km.) northeast of Redding and is served by drainage basins of 4385 square miles (11,357.15 square km.), from which the minimum flow is about 2400 second-ft. (67.2 cu. m. per second). The head utilized will be about 940 ft. (282 m.), and at minimum flow it is expected that 180,000 hp. will be developed. The installed capacity is to be 200,000 kw.

The construction involves a diversion dam which will divert the stream into a 7-mile (11.27-km.) conduit, of which 6 miles (9.36 km.) will be in tunnel and one mile (1.61 km.) in reinforced-concrete pipe. The tunnel is to have a grade of 1 in 1000 and will be kept under a head of about 50 ft. (15 m.). Small storage capacity sufficient for daily load fluctuations will be provided in the forebay.

The present construction schedule calls for the following expenditures: First year, $300,000; second year, $1,500,000; third year, $2,000,000; fourth year, $7,000,000; fifth year, $6,700,000; total, $17,500,000. Waterwheels and generators are to be purchased last so as to afford the advantage of such improvements in design as may take place.

This year's work is to be a continuation of the two exploration tunnels begun by the Mount Shasta Company. These tunnels are now 7 ft. by 7 ft. (2.1 m. by 2.1 m.) in section. They will probably be advanced as the top headings for a larger bore. A tunnel 20 ft. (6 m.) in diameter is to be the size for supplying the plant now proposed. Voltage of the transmission line to connect with the company system has not been decided but will not be less than 110,000 volts. The State Water Commission estimates a total of 412,000 hp. available on the Pit River without storage.

CAPITAL REQUIREMENTS NOT TO BE DIMINISHED

Vice-President Hockenbeamer of Pacific Gas & Electric Company Discusses Construction Outlays, Higher Costs and Rates

At the recent annual meeting of stockholders of the Pacific Gas & Electric Company, San Francisco, Cal., A. F. Hockenbeamer, vice-president and treasurer, showed that, notwithstanding the cessation of the temporary exposition revenue of 1915, the gross business in 1916 increased $85,000 over the total of 1915.

In speaking of the fact that expenses and taxes in 1916 increased $353,000, causing a decline in net operating revenue of $138,000, Mr. Hockenbeamer said:

"We have selected twenty-nine representative articles that are in common use in our gas and electric departments, and taking the actual quantities of these bought by us in 1916 and applying to these quantities prices prevailing before the outbreak of the war, prices a year ago and prices now prevailing, obtained the following results: Cost at prices in January, 1914, $617,000; cost at prices in January, 1916, $796,000; cost at prices in January, 1917, $1,242,000. This excludes oil, which has gone up more than 50 per cent and at present prices will cost us about a million dollars more in 1917 than it cost in 1916.

"It will be noted from the foregoing that between January, 1914, and January, 1916, there was an average advance in the cost of materials of 29 per cent, and between January, 1916, and January, 1917, a further advance of 72 per cent, the total advance for the entire period of three years being 101 per cent. Since this compilation was made prices have gone up still more. There is no public regulation to limit the prices and profits which we are compelled to pay for supplies.

"In 1910 our taxes were $383,000. In 1916 they were $973,000, an increase of $590,000, or 154 per cent in five years. During this period gross revenues increased 35 per cent and net revenues 50 per cent. During the present year there will be a further increase in our taxes, irrespective of any increase brought about by larger earnings or by 'war taxes.'"

Mr. Hockenbeamer expressed confidence that the growth of the future will fully equal that of the past, and that the new money invested in the business during the last five years, pretty close to $25,000,000, is a fair measure of the additional investment that will have to be made in the next five years.

Taking only the more important items of work, the company has to-day more than $2,000,000 of construction under way. Mr. Hockenbeamer added:

"In the circumstances of higher taxes and higher costs for practically everything that enters into their products, including new capital, it is essential that utilities be permitted to recover these greater outlays in their rates unless development is to be arrested or brought to a standstill."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Commission Not Bound to Acquire Information Entirely from Evidence Produced Before It.—The Public Service Commission as an administrative and regulative body is not bound to acquire its information concerning all matters involved in a proceeding before it entirely from the evidence of witnesses or other evidence produced before it, but may take into consideration the results of its general investigations, general information upon a given subject within its powers, and all matters which affect the matter and concerning which it must determine the facts, the Supreme Court of Washington held (163 P. 1143).

Power of Freeholders in Relation to Public Service Commission.—A law authorizing the freeholders of certain cities to form and adopt a charter for their government does not authorize them to assume all powers the State may exercise within the city limits, but only those powers incident to the city as a municipality or which concern matters of purely local government, and the St. Louis charter clauses empowering the city to regulate the construction, maintenance, etc., of public utilities, to compel reasonable extensions of facilities for such service, giving the Board of Aldermen full power to regulate charges and establish necessary requirements to secure efficient use, service and products of public utilities, are invalid as conflicting with the powers given the Public Service Commission over public utilities wherever they may be situated in the State, according to the Supreme Court of Missouri (192 S. W., 958).

Use of Public Lands for Electrical Generating Purposes.—No right to use the public lands as sites for works employed in generating and distributing electric power can be founded upon the provisions of the act of March 3, 1891, relating to rights-of-way for ditches, canals and reservoirs for the purpose of irrigation, and calling for the filing of maps of location which are to be effective and noted upon the public records when approved by the Secretary of the Interior, or upon the provisions of the act of May 11, 1898, permitting rights-of-way "approved" under the earlier statute to be used for certain additional purposes, including the development of power "as subsidiary to the main purpose of irrigation," where no maps of location have been filed or approved and where the rights-of-way are not claimed merely for ditches, canals or reservoirs, and irrigation is neither the sole nor the main purpose for which any part of the asserted rights-of-way is used, it was held by the U. S. Supreme Court (37 S. C., 387). Those who have not conformed to the requirements of the act of Feb. 15, 1901, and have received no permission or license under it can claim no right under such statute to use the public lands as sites for works employed in generating or distributing electric power. The right to use the public lands in forest reservations as sites for works employed in generating and distributing electric power some of which is sold in adjacent or distant towns, or to those who are engaged in mining or milling or in reducing ores, was not given by the act of Feb. 1, 1905, which provided for rights-of-way in forest reserves for ditches, canals, reservoirs and the like (making no provision for power houses, transmission lines or subsidiary structures) "for municipal or mining purposes and for the purposes of the milling and reduction of ores." No understanding and agreement with the officers or agents of the United States can estop the government from questioning the rights to use the public land in forest reservations as sites for works employed in generating and distributing electric power. The United States is not estopped to question the right to use public lands in forest reservations or sites for works employed in generating and distributing electric power because the agents in the Forestry Service and other government officers and employees, with knowledge of what the power companies were doing, not only did not object thereto but impliedly acquiesced therein until after the works were completed and put into operation. Those using the public lands in forest reservation as sites for works employed in distributing electric power without seeking a license or permit under the act of Feb. 15, 1901, or conforming or offering to conform to all lawful administrative regulations promulgated under that statute, are not in a position to complain that some of such regulations go beyond what is appropriate for the protection of the interests of the United States and are unconstitutional, unauthorized and unreasonable. Congressional enactments providing or recognizing that rights to the use of water in streams running through the public lands and forest reservations may be acquired in accordance with local laws have no application to a controversy over the right to use the public lands and forest reservations as sites for works employed in generating and distributing electric power. Appropriate compensation to the United States for the past use and occupancy of public lands in forest reservations as sites for works employed in generating and distributing electric power without the consent of the United States and contrary to its laws should be included in a decree enjoining such use, and should be measured by the reasonable value of the occupancy and use, considering its extent and duration, and not by the scale of charges fixed by administrative regulations promulgated by the act of Feb. 15, 1901, for use and occupancy under a license or permit granted under that statute.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Bonds Limited to Amount of Capital.—In a decision affecting the Kansas City Light & Power Company, the Missouri Public Service Commission holds that manufacturing and business corporations, including public service utilities owning and operating electric light and power plants, are within the terms and subject to the provisions of Section 2981, R. S. 1909, in so far as said section limits the bonded indebtedness of a corporation to the amount of the authorized capital.

Basis of Indiana Purchase.—The Indiana Public Service Commission has decided a proposed purchase and sale case, involving five utilities of southern Indiana. The commission denied the petition of the Indiana Power & Water Company, Edwardsport, Ind., to buy two electrical plants at Vincennes, Ind., one at Dugger, Ind., and one at Petersburg, Ind., through the issuance of $776,000 securities. The commission engineers had reported the present value of the physical properties of the companies as below that of the securities which the company asked to have authorized. The engineers reported the present physical value to be $410,000 and the reproduction value $473,409. In this valuation 12½ per cent was included for overhead charges during construction, but no intangibles were taken into consideration. Engineers for the company checked the valuation of the commission engineers and made the present value total $416,000. The company's attorney claimed added values of $94,000 for cost of securing business, $28,000 for promoter's profit and $53,000 bond discounts and brokerage. The company also asked $385,830 as a "strategic value" because the central station of the company is so located that it can easily handle the service for the four properties to be purchased. The commission denied the petition on the ground that it would not be good public policy to authorize such an amount of securities on the physical value, although it announced that it realized the unusual conditions which now exist. The commissioners also pointed out that the purchasing company in all probability could give the customers of the companies better service and possibly at a lower rate. There was, therefore, no disposition on the part of the commission to stop the progress of the sale, and the only desire was to insure that it was made on a basis that would not work hardship either on customers or on the investing public. The commission suggested that it would permit the company to bond the property to be purchased up to $400,000 and would permit the issuance of stock of not to exceed $200,000.

Further Electrification on St. Paul Railway.—To meet the increasing cost of fuel oil, the Chicago, Milwaukee & St. Paul Railway has begun to electrify the Puget Sound end of the transcontinental line. This part traverses the great virgin forests of Washington, and oil has been used to avoid danger of forest fire from sparks.

Uniform Accounting in Pennsylvania.—The Public Service Commission of Pennsylvania has called a conference of representatives of electric light, heat and power companies for June 6 to arrange plans for the adoption of a uniform annual report by the different utilities. Tentative drafts of the proposed form will be submitted, and a suitable date for general adoption by the companies arranged.

Extension of Washington Water Power Service.—The Washington Water Power Company, Spokane, Wash., is negotiating with mine operators in the north side of the Cœur d'Alene region to furnish power for the operation of mines and mills. Line construction and transformer installation would involve an expenditure of $50,000, according to M. C. Osborn, commercial agent for the company. The lines would total 25 miles. Extensive development of properties in that region has been retarded by lack of power.

New York Edison Company Record Week in New Contracts.—One week's new business secured recently by the wholesale bureau of the New York Edison Company reached a total of 1802 hp. and 28,640 lamps, representing an aggregate of 55,670 50-watt equivalents. Included in these were contracts for five new buildings, the installations of which consisted of 9000 incandescent lamps and 440 hp. of 15,600 50-watt equivalents. Three private plants were closed down with an installation of 6520 incandescent lamps and 220 hp., the equivalent of 9820 30-watt lamps. These and the seven remaining contracts totaled 55,670 50-watt equivalents.

Examination for Cable Tester.—The New York Municipal Civil Service Commission announces an examination for cable tester, for which applications will be received at Room 1400, Municipal Building, New York City, until June 5 at 4 p. m. From the resulting list appointments will be made to the Fire Department. The duties are to locate breaks and test for electrolysis of cables and to make acceptance tests on and inspection of wires and cables, underground conduits, manhole accessories, fire-house and public-building wiring for alarm systems and pole-line equipment. Candidates must be United States citizens and residents of New York State, at least twenty-one years of age, and have had actual factory, laboratory or field experience in cable testing of at least one year, or have completed a full year's laboratory testing course in electricity at a recognized institution, and should have a general knowledge of the principles of electricity and familiarity with the various electrical testing appliances appertaining to this position. The position pays from $1200 to $1500 per annum.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Montana Power Increases Common Dividend.—The Montana Power Company has declared a quarterly dividend of 1¼ per cent on common, and a regular quarterly dividend of 1¾ per cent on preferred, both payable July 2 to stock of record June 15. This places common stock on a 5 per cent annual basis, compared with 4 per cent heretofore.

Seeks Injunction to Prevent Competition.—The California-Oregon Power Company is seeking in the United States Court an injunction against city officials of Klamath Falls, Ore., to prevent them from submitting an ordinance on the June ballot granting a franchise to a competing electric light and power company. The company alleges that the proposed franchise cannot be legally placed on the ballot because it was prepared in violation of the city charter. It is further declared that the cost of the election would add to expenses of taxpayers, of which it is one of the heaviest. The Keno Power Company is the concern that wishes to enter the field.

Power Resources of Italy.—United States Consul E. T. F. Dumont writes from Florence, Italy, that French engineers have estimated that Italy could develop 5,000,000 hp. from its streams and torrents, and some Italian engineers have estimated the total developed and undeveloped at 4,000,000 hp. If the mean of these estimates, 4,500,000 hp., is assumed to be correct, and the 800,000 hp. already developed is deducted, there remains 3,700,000 hp. yet to be developed. To replace the energy obtained from imported coal used in railways and industries about 1,150,000 hp. must be further deducted, leaving a surplus over all present uses of 2,550,000 hp., more than sufficient to double the power now in use in the country.

Contracts Help United Light & Railways Company.—President Frank T. Hulswit of the United Light & Railways Company, Grand Rapids, Mich., reports that the company and its subsidiaries are affected comparatively little in net earnings by existing high prices in the matter of operating supplies and material because of favorable long-time contracts entered into before present conditions arose. For instance, the company's principal gas contract was negotiated in 1914, to run for a period of five years; its oil contract, at a cost of approximately 40 per cent of the present price, runs until Jan. 1, 1918; its largest steam coal contract, covering three-fourths of its steam-coal consumption for the year, is at a figure appreciably less than $1 per ton f.o.b. mines.

Lignite for Fuel in Australia.—United States Commercial Attaché Philip B. Kennedy writes from Melbourne, Australia, that the city electrical engineer of Melbourne, in delivering his presidential address before the Victorian Institute of Engineers, proposed the construction of a large power plant in Melbourne which would utilize brown coal, or lignite, of which there are large deposits adjacent to Melbourne.

Protective Society of Massachusetts Utility Stockholders.—With the avowed purpose of increasing dividends to stockholders in Massachusetts gas and electric properties, Edwin F. Dwelley and George Nichols of Lynn have organized the "Society of Stockholders of Gas and Electric Light Properties of Massachusetts," with offices at 15 Beacon Street, Boston. A statement explaining the organization contends that the constructive regulative policy of the Massachusetts Gas and Electric Light Commission which prevailed during the life of the late chairman, Mr. Barker, has been completely overthrown and that since July, 1916, when Commissioner Lewenberg was appointed, there has been a loss in the market value of the shares of forty of the principal companies totaling $24,477,000, or $30.30 per share. Taking the Cambridge Electric Light Company as an example, the society promoters claim that the dividends of a stockholder owning seven shares should be paid, not on $700, but on $5,544, the value of property underlying the seven shares. Tabular data are printed showing the relation between par value and property value, dividends, accumulated profits, new stock and market values of the principal gas and electric properties of the State.

Occupations of Electrical Engineering Graduates.—The results of an analysis of the activities of the alumni of the School of Electrical Engineering of Purdue University made during the last year was published in a news letter issued by the university. Of the 705 graduates from the School of Electrical Engineering during the ten years ended June, 1915, the percentage engaged in various lines of work is indicated in the following table: Manufacturing, 250, or 35.4 per cent; operating railway, 138, or 19.6 per cent; telephone and telegraph, 46, or 6.5 per cent; public, 16, or 2.2 per cent; teaching, 43, or 6.1 per cent; non-electrical engineering, 32, or 4.5 per cent; non-engineering, 58, or 8.2 per cent; miscellaneous engineering, 71, or 10 per cent; unaccounted for, 28, or 3.9 per cent; number in class, 705; deceased, 23, or 3.2 per cent. Commenting upon these figures, C. Francis Harding, professor and head of the School of Electrical Engineering, said that during the last few years there has seemed to be a greater tendency for electrical engineers to enter situations of a more or less commercial nature with the utilities and other positions requiring a broader training than was the case ten years ago. The course in electrical engineering is being revised from time to time to meet the changing needs of the engineering profession.

American Society for Testing Materials.—The American Society for Testing Materials will hold its twentieth annual meeting at Atlantic City, N. J., on June 26-29.

Schenectady Section, A. I. E. E.—A. G. Empey addressed the Schenectady Section of the American Institute of Electrical Engineers on May 25 on "Personal Experiences in the European War."

Iowa Section, N. E. L. A.—The annual convention of the Iowa Section of the N. E. L. A., scheduled for May 24-25, was postponed in line with the policy adopted by other national and state organizations.

Atlanta Section, A. I. E. E.—The following officers were elected recently by the Atlanta Section of the American Institute of Electrical Engineers: Chairman, A. M. Schoen; vice-chairman, E. P. Peck; secretary, Thomas C. Talliaferro.

Cleveland Section of the A. I. E. E.—The annual banquet of the Cleveland Section of the American Institute of Electrical Engineers was held on May 25. After the dinner the meeting was addressed by John B. Taylor, consulting engineer of the General Electric Company, on acoustical engineering. The talk was illustrated.

Annual Meeting of the American Society for Testing Materials.—The twentieth annual meeting of the American Society for Testing Materials will be held on June 26 and 29 at Atlantic City, N. J. The subjects scheduled for discussion are: "Tests and Testing," "Steel and Iron," "Non-Ferrous Metals," "Preservative Coatings and Miscellaneous Materials," "Cement and Concrete," "Concrete and Lime," "Ceramics," "Miscellaneous Materials."

The Jovian Electric League of Kansas City, Mo.—Since entering more fully into civic work, this league has appointed a committee to agitate the electrical illumination of the flag recently erected on the Union Station plaza. In addition, a committee has been appointed to investigate city ordinances that involve electrical matters. L. E. Shoemaker, secretary, has resigned because of work connected with the military organization in the Bell Telephone Company, and T. R. Harber has been elected to succeed him.

Fort Wayne Section of the A. I. E. E.—The Fort Wayne Section of the American Institute of Electrical Engineers has deviated from the usual custom of confining lecture subjects to technical matters only and restricting the attendance to members of the section by placing upon the program the names of men unusually qualified to talk upon subjects of interest to the general public. All wide-awake and active clubs of the city, as well as interested individuals, are invited to the meetings. This section recently had an electrical exhibition, known as "The Electrical Home," which was given May 10 and 11. The specific accomplishment of this section has been the education of the public.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 1095 of this number.

Engineers' Club of Philadelphia.—An address on "The Engineers' Club of Today and To-morrow" was given at the recent annual meeting of the Engineers' Club of Philadelphia, by the president, Emmett B. Carter.

Portland Section of the A. I. E. E.—At a recent meeting of the Portland Section of the American Institute of Electrical Engineers R. W. Mastick presented a paper on "A Field Investigation of Inductive Interference in Telephone Circuits Arising from Parallelism with a 55,000-Volt Power Circuit."

Philadelphia Section of the Illuminating Engineering Society.—"A Year's Progress in the Manufacture of Mazda Lamps" was the subject of a talk by Unit Rasin before the Philadelphia Section of the Illuminating Engineering Society on May 18. Dr. H. E. Ives continued his "Elementary Talks," which were started at a previous meeting of the society.

Buffalo Section, N. E. L. A.—Prizes were given for competitive papers prepared by members of the Buffalo Section of the N. E. L. A. at a recent meeting. Following are the prize winners, the title of the papers and the amount of the prizes: First prize ($40), George R. Kinney, subject "Educating the Public Through the Education of the Employee"; second prize ($25), Henry H. Lyon, subject "Demand and What It Means"; third prize ($15), George J. Richert, subject "Plugging Up Some Leaks"; fourth prize ($10), Charles W. Barber, subject "The Life of a Lamp"; fifth prize ($5), Charles L. Smith, subject "Education in Business"; sixth prize ($5), Cromwell McIntosh, subject "Continuity of Service."

Metering of Large Power Installations.—A meeting of the electric meter committee of the Empire State Gas and Electric Association was recently held, the subject of the discussion being "Metering of Large Power Installations." C. G. Durfee, chairman of the committee, presided. In general the discussion related to various types of indoor and outdoor metering installations used by the different companies, the methods and difficulties in testing large meters, the precautions taken to insure against accidents to the men testing and reading meters, the use of various types of meters for measuring demand, and the prevention of errors in reading meters or in billing consumers for an inaccurate number of kilowatt-hours. Representatives of the General Electric Company and the Westinghouse Electric & Manufacturing Company reported progress in the work of improving demand meters.

Connecticut Get-Together Club Will Hold Annual Outing.—The fourth annual outing of the Connecticut Get-Together Club of the National Electric Light Association will be held at Cosey Beach, East Haven, Conn., on June 9.

Association of Iron and Steel Electrical Engineers.—The Cleveland Section of this association will hold a meeting in October, the principal purpose of which is to form a permanent organization out of the Cleveland Section.

Jovian Electric League of Los Angeles.—At the regular luncheon of this association held May 23 Prof. A. T. Atkins spoke of "Choosing a Vocation and the Scientific Placing of Employees." F. T. Maessen, Pacific Power & Light Corporation, acted as chairman of the day.

Spokane Section, A. I. E. E.—On May 18 the Spokane Section of the American Institute of Electrical Engineers held its annual meeting. The following officers were elected for the ensuing year: Chairman, C. A. Lund; vice-chairman, George Nixon; secretary-treasurer, J. E. E. Royer, and executive committee, J. W. Hungate, R. S. Daniels and George Harding. After the business session there was a discussion on "Engineering Education."

National District Heating Association.—The ninth annual convention of the National District Heating Association will be held in Detroit, Mich., June 12 to 15 inclusive. Following are a few of the interesting reports and papers that will be presented: Report of station-operating committee, by J. G. DeRemer, chairman; report of underground construction committee, by H. A. Austin, chairman; underground crossings, by H. R. Wetherell; ash and coal handling problems, by J. L. Hecht and J. C. Martin, and temperature regulation, by H. R. Wetherell.

American Association of Engineers.—On account of the amount of business which had to be handled, the third annual convention of the American Association of Engineers, which was held in Chicago, extended over five days instead of two days, as originally intended. The following candidates were nominated: National director, R. C. Yeoman, dean of engineering, Valparaiso University, Valparaiso, Ind., and William H. Sallwasser, instructor, school of American Bridge Company, Gary, Ind.; national auditing committee, Samuel Morell, Jr., J. T. Mullin and C. A. Gaensslen. Members will have the opportunity to signify their choice by mail. The convention adopted a resolution offering the national headquarters as a recruiting station of the United States Army. In addition, a resolution was adopted extending an offer of membership in the association to all enlisted men who possess the qualifications of membership. Such membership is to be free of all initiation fees and dues during the term of enlistment. All members of the association who enlist will be carried during the term of enlistment without the payment of dues.

F. C. Taylor has been appointed assistant chief engineer of the Tampa (Fla.) Electric Company.

H. J. Sears has been promoted to be system operator of the Mississippi River Power Company, succeeding W. E. Corr.

W. E. Corr, system operator of the Mississippi River Power Company, succeeds B. H. Menke as superintendent of substations.

L. N. Howell, former chief engineer of the Baton Rouge (La.) Electric Company, has accepted a position in the power station at Maryville, Tenn.

H. R. Sharpless, formerly of the Woonsocket (R. I.) Electric Company, is now chief engineer of power station of the Baton Rouge (La.) Electric Company.

Fred E. Sterling, chairman of the Republican State Committee of Rockford, has been appointed by Governor Lowden a member of the State Public Utilities Commission of Illinois, effective July 1, 1917.

Thomas E. Dempcy of East St. Louis has been appointed chairman of the State Public Utilities Commission of Illinois. Mr. Dempcy for the last eleven years has been in the State's service as assistant attorney general.

B. H. Menke, superintendent of substations of the Mississippi River Power Company, has been transferred by the operator, the Stone & Webster Management Corporation, to the Connecticut Power Company, to fill the position of superintendent of transmission lines and substations.

A. S. Nichols, formerly manager of the Fort Madison (Iowa) Electric Company, will shortly become manager of the Paducah companies under the Stone & Webster management, succeeding W. L. Weston, who has been transferred to Houghton, Mich. Mr. Nichols was formerly assistant treasurer of the Mississippi River Power Company.

L. J. Hirt, formerly vice-president of the Pearson Engineering Corporation, has been appointed consulting engineer for the United Gas & Electric Engineering Corporation and will supervise the construction and engineering affairs of the subsidiary companies of the corporation. Mr. Hirt has been connected with the Pearson Engineering Corporation since 1889, and has had a wide experience in that company's enterprises in this country and in many foreign countries as well, embracing all classes of engineering undertakings.

Edward T. Moore, who has been connected with the Westinghouse Electric & Manufacturing Company for a number of years, has recently become connected with the Halcomb Steel Company and the Syracuse Crucible Steel Company, Syracuse, N. Y., as electrical engineer. While with the Westinghouse company Mr. Moore did considerable development work and invented a device used extensively in paper mills known as an automatic grinder regulator. For the last year he has supervised the erection of this apparatus in a large number of paper mills throughout the United States and Canada.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

C. E. Clewell, assistant professor of electrical engineering at the University of Pennsylvania, Philadelphia, has been appointed a member of the National Committee on Lighting Defense representing the Council of National Defense.

Ludwig Kemper, who until quite recently was secretary-treasurer and manager of the Minnesota Gas & Electric Company at Albert Lea, Minn., and later was connected with the Field-Richards Company of Cincinnati, Ohio, has been appointed president, manager and purchasing agent of the Spokane Heat, Light & Power Company. Born in Holland in 1887, Mr. Kemper received his engineering education in Europe and after two years of industrial engineering there came to the United

LUDWIG KEMPER

States, where he was employed by the Pullman company on car-lighting design. In 1903, following a period of consulting engineering, he became assistant electrical engineer for the Baltimore & Ohio Railroad, resigning two years later to become connected with the Albert Lea property. For the last two years Mr. Kemper has been president of the Minnesota Electrical Association.

E. Darrow has resigned as manager of the Spokane Heat, Light & Power Company and is succeeded by Ludwig Kemper of Albert Lea, Minn.

Harry A. Flood has resigned as president of the Spokane Heat, Light & Power Company. Mr. Flood retains the presidency of the holding company.

Howard N. Bates, who has been for many years connected with the commercial department of the Houston (Tex.) Lighting & Power Company, has accepted the position of commercial manager of the Public Service Corporation at Tulsa, Okla.

A. O. Blackman has been appointed superintendent of power and plant of the Yale & Towne Manufacturing Company, Stamford, Conn.

Paul B. Findley, formerly editor of the *Electrical Age*, New York, has accepted a position with the Westinghouse department of publicity, with headquarters at East Pittsburgh.

Victor W. Kliesrath, for many years chief engineer of the Bosch Magneto Company, has severed his connection with that company. Mr. Kliesrath's plans for the future have not as yet been announced.

Paul A. Sinsheimer, who has been head of the stock and bond department of the California Railroad Commission for nearly five years, has resigned to become assistant to the president of the Union Trust Company.

Frank Y. Low has been elected president and director of the General Engineering & Management Corporation and vice-president and director of both the Interstate Electric Corporation and the Commonwealth Light & Power Company. Mr. Low has for many years been associated with H. M. Byllesby & Company, Chicago.

W. Lawrence Weston, for several years local manager of the Stone & Webster properties at Paducah, Ky., the Paducah Light & Power Company and the Paducah Traction Company, has been transferred by the owners to Houghton, Mich., succeeding Otto Snyder as general superintendent of the Houghton County Electric Light Company.

N. P. Zech has been elected vice-president and director of the General Engineering & Management Corporation and the Commonwealth Light & Power Company as well as vice-president of the Interstate Electric Corporation. Mr. Zech was at one time assistant to the general auditor of H. M. Byllesby & Company, resigning to become treasurer and general auditor of the Atlantic Gas & Electric Company, which several months ago was taken over by the Barstow interests.

John F. Wessel was receitly elected a vice-president of the United Gas & Electric Engineering Corporation and will take charge of the operation of the Northern properties, succeeding S. J. Dill. Mr. Wessel, who has been identified with lighting and railway interests for many years, is a graduate of the Massachusetts Institute of Technology. Prior to coming to New York at the end of 1913 he was general manager of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio.

Obituary

William J. Livingston, chief engineer of the Rankin plant of the Duquesne Light Company, Pittsburgh, Pa., died at his home on May 11 of cerebral hemorrhage. Mr. Livingston was born in Ireland Jan. 14, 1863. He was first employed by the company in 1904, and was appointed to the position he held at his death in 1906.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

NOTE OF CAUTION IN SUPPLY JOBBING MARKET

Belief Prevalent That Peak in Electrical Prices Has Been Reached—Stocks Show Slight Recessions from Former Prices

Conditions have actually changed very little in the electric supplies market during the past month, but nevertheless the entire undertone is far more cautious, and the feeling of uncertainty seems to exist everywhere. There has been no slump in the market, but neither have there been any notable advances. In fact, there has been less change in prices of electrical materials during the past month than in any month during the last twelve. In a few cases there have been slight revisions downward, some of these prices having later gone back.

To the trade in general, however, these signs are as the handwriting on the wall, and they are being heeded without much question as to whether they have any real significance. It is pretty generally felt that the peak in prices of electrical supplies has been reached, although some few items may go higher. Opinion, however, seems divided as to the future trend of prices. Some look for a small drop in the near future, while others feel that the peak will continue for some time. The former undoubtedly base their opinions on the tendency of the price of certain materials to sag during the last few weeks, while the others believe that with the demand and the volume of unfilled orders manufacturers would not be inclined to consider any revisions downward, at least for some time to come.

New England

A slight recession in trade is noted by New England electrical jobbers, but this is not regarded as anything more than temporary. The importance of keeping business at full tide is being realized more and more, and confidence is certain to become greater as the immense weight of the United States is more and more felt in the great world conflict. Prices remain at their former high levels, and still further advances are anticipated. Deliveries are somewhat improved, especially in cases where pressure has been brought to bear upon manufacturers and transportation companies to expedite the completion and forwarding of orders placed some months ago. Some difficulty obtains still in regard to obtaining motors, notably in the larger sizes.

Women are being employed more and more in the New England electrical jobbing industry as junior clerks, and as the selective draft comes into play there will undoubtedly be a considerable development in the extension of feminine capabilities to meet present abnormal conditions. Central stations are still somewhat inclined to hold back as regards development work.

On account of unseasonable weather conditions, electric fans have not begun to move in large volume as yet, but a healthy business in these outfits is anticipated, and is, in fact, forecast by advance orders. The hesitation displayed by the public in regard to appliance purchases is expected to yield soon to the growth of confidence regarding the business future.

East and South

Eastern jobbers are experiencing a good demand, although some cautiousness is noted in buying. While prices have changed but little during the past month, there is a well-defined feeling that the peak has been reached, and until more definite information is available speculation will be far less popular.

Jobbers' stocks are not so large as they were a month ago. They are not low yet, however. Inability of manufacturers to obtain sufficient supplies of raw materials, and railroad embargoes, are given as the chief reasons for lower stocks.

The demand is not particularly large in any direction, but is general. Household appliance sales have fallen considerably.

In the North there seems to be practically no change in the credit situation, but in the South a tendency is noticed toward worse credit conditions.

Optimism still prevails, and it is pretty generally agreed that the immediate outlook is promising. One concern sees in government work a stabilizing factor for the industry. Supplies for government work, it is felt, will constitute no small part of the jobbing trade.

Middle West

In general, jobbing prices in the Middle West are steady and firm. Increases, rather than lower prices, are expected. The last month has brought radical changes in all steel products, both in the price advances and in scarcity of finished goods, including conduit, boxes and their accessories. The jobbers' stocks of these materials are in general about normal. The jobbers' customers are able to buy these materials at the prevailing market for delivery now. To purchase these materials to replenish stocks, the jobber must place orders with manufacturers, subject to shipment at the price prevailing on the day of shipment. For this reason, orders for future delivery are being accepted by the jobbers themselves on practically the same basis. On the general run of schedule material, stocks are about normal, and it is difficult to replenish many lines. From the industrial centers heavy buying is expected on account of the belief that the industrial plants will be large gainers by the government's building program. It is also said that while light and power companies and independent telephone companies are purchasing sparingly for expansion, the Bell telephone interests are in the market for large quantities of goods. The reason for this, it is said, is necessity created by the demand made on the Bell system in the larger industrial communities, where its main strength lies. It is the general belief that buying will continue heavy, as it has been, but no new buying peak is expected. Credits and collections are considered most favorable.

Pacific Coast

In general, conditions on the Pacific Coast are good. There has, as yet, been no marked falling off of business on account of national crisis, and, on the other hand, extension of industrial business, army and navy activity, and shipbuilding needs, have more than offset economies that have been effected.

Practically no change in prices has occurred this month in the Southwest. There were two or three slight decreases. but these were promptly brought back again to the same figures as before. Stocks are in practically the same condition as last month.

It is believed that expenditure for those things which the public considers luxuries—and many classes of socket appliances are still so considered by the general public—will be light. Therefore, in the next few months the orders for the less stable socket appliances will probably be decreased. Extensions to factories and industrial plants generally have kept demands in this line well above normal. Army and navy work is very active, and there has been some pole hardware activity to supply new industrial business. One of the notable features of the present market is the shipbuilding industry, which calls for large quantities of large-sized wire. One large Pacific Coast company is now regularly stocking about 20,000 ft. of wire of this size, whereas a 2000-ft. stock was considered ample in prewar times.

Collections have been good, particularly so with the small concerns. Dealer and contractor credits, however, are being watched more closely than ever, particularly those dealers who depend upon trade in residence districts. It is expected that this class of business will fall off.

The larger electrical supply houses in the north Pacific Coast field report less change in prices during the month of May than for several months past. This does not mean that prices have not changed. Steel has advanced, and the price of wire has decreased noticeably. Other materials remain about the same as reported for April.

The fact that wire is more easily obtained, and has dropped in price, leads many of the dealers to believe that the peak in prices and buying has about been reached. Buying for the future is considerably lighter. Dealers are more or less apprehensive of being caught with an overstock, purchased, in some cases, when materials were steadily climbing upward. It is the belief locally that prices will not go much higher, although this feeling is not predicated on anything more stable than rumors and opinions emanating from those who are presumed to know.

Consequently, if these rumors of "peak has been reached" persist, buying will be light until prices drop or indications point to a further and prolonged increase.

Shipbuilding activities continue unabated, and the wooden-ship construction is booming. Government demands for materials remain strong, and are a valuable asset to the electrical business. Building, particularly of business structures, hotels and apartments, is at a low ebb. This is due to the high prices of building materials.

Collections are good. There is plenty of money in evidence.

EXCELLENT DEMAND FOR SEWING-MACHINE MOTORS

Some Manufacturers Forced Temporarily to Discontinue Production, or Else Have Ceased to Push Sales Owing to Market Conditions

Electric sewing-machine motors have had a large demand since the publicity campaign, which was started almost simultaneously by a number of manufacturers and distributers, has been in effect. While electric sewing-machine motors have been on the market for a number of years, it was not until recently that any movement was made in a large way to promote the sale of this class of equipment.

Some manufacturers who have been producing motors for this use have quite recently either discontinued temporarily their manufacture or have ceased for a time to push their sale, owing to the demand for motors for other purposes, for which there has been a well-defined and established market.

Those who still continue to market sewing-machine motors find that the market has exceeded first estimates, and that it is only with difficulty a sufficient number of motors can be obtained to supply the demand.

AMERICAN EQUIPMENT FOR NEW ZEALAND

The Exclusion of Electrical Apparatus of German Manufacture Leaves Fair Opening for Other Exporting Nations

The exclusion of Germany as a supplier of electrical equipment has afforded a fair opening for American enterprise in this direction in New Zealand, according to a recent British report. British manufacturers being otherwise engaged at the moment, American houses are taking opportunity further to consolidate their already extensive business connections in New Zealand in the matter of electrical supplies. There is yet to be considerable development of water-driven electric power and lighting systems in New Zealand for industrial and municipal purposes. The country is generally rich in watercourses suitable for the purpose, and this in both islands. Already at Whangarei, in the Auckland province, the largest cement works in the Dominion are about to start operations, relying solely upon electric power, the turbines being at Wairua Falls, 17 miles distant. The plant is almost wholly American and the cement-making plant is also from the United States. The value of the electrical equipment is about $2,000,000. The possibilities of the profitable use of electric power for hauling in mines and heavy work generally are likely to be great in New Zealand in the near future, especially when the current high rates for manual labor of every description are taken into consideration.

TRADE NOT BACK OF ELECTRICAL MERCHANDISE

Survey Discloses that Wider Distribution Can Be Had if Manufacturers Cultivate Central Stations and Other Selling Organizations

Industrial electrical merchandise because of the attitude of the trade toward it is not having the wide sale that this class of goods should have. Such apparatus, it has been found after a brief survey of the market, is being distributed almost entirely through non-electrical channels.

Central stations have taken up the sale, distribution and advertisement of household electrical merchandise, but when it comes to the industrial appliances few companies have made any real effort to further their sale. It is not thought that the central stations have any prejudice against this class of equipment; rather it is believed that the manufacturers have not yet awakened to the need of selling the idea to the central stations.

Manufacturers, to be sure, have had a good trade, but the goods have really sold themselves. Mill jobbers and the mill trade have been the selling agencies. They are non-electrical and have no more reason for selling an electrical device than some other device.

Recently the opinion has been expressed in different quarters that considerably more business would result if the manufacturers would take pains to cultivate the central stations and the electrical trade.

METALS MARKET CONTINUES FIRM

Not Much Buying, but Short Stocks Have a Tendency to Hold Up Prices

The metals market seemed firmer at the opening of this week than for a long time. There has not been much buying, but stocks are low. Nearby copper went up about a cent a pound because producers are out of June and July copper. There was less buying in lead last week, but stocks were very low. Old and scrap metals now are bringing in many instances almost as high prices as are new metals.

Nominal quotations for electrolytic copper on Monday of this week were as follows: May, 32.5 cents; June, 32.37½ cents; July, 31.37½ cents; third quarter, 29.5 cents, and fourth quarter, 28.5 cents.

NEW YORK METAL MARKET PRICES

	May 22 Selling Prices Bid	May 22 Selling Prices Asked	May 28 Selling Prices Bid	May 28 Selling Prices Asked
Copper:	£ s d		£ s d	
London, standard spot	130 0 0		130 0 0	
Prime Lake	31.50	to 32.50†	31.50	to 32.50†
Electrolytic	32.00	to 32.50†	32.25	to 32.75†
Casting	30.00	to 31.00†	30.50	to 31.00†
Copper wire base	37.00	to 38.00†	37.00	to 38.00†
Lead	10.00		10.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	19.00		19.00	
Spelter, spot	9.42½	to 9.67½	9.42½	to 9.67½
Tin, Straits	65.62½		65.00	
Aluminum, 98 to 99 per cent.	56.00	to 58.00†	56.00	to 58.00†

OLD METALS

Heavy copper and wire	28.50	to 29.50	28.00	to 28.50
Brass, heavy	17.00	to 18.00	17.50	to 18.00
Brass, light	14.00	to 14.50	14.25	to 14.75
Lead, heavy	9.00	to 9.25	9.00	to 9.25
Zinc, scrap	6.75	to 7.00	7.25	to 7.50

†Nominal.

Current Prices of Electrical Supplies

The prices quoted are those prevailing in standard package or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists to contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List, per 1000 Ft. Chicago	N. Y.
No. 14 solid	$61.00	$61.00
No. 12 solid	71.00	71.00
No. 10 solid	90.00	90.00
No. 8 solid	106.00	106.00
No. 6 solid	145.00	145.00
No. 10 stranded	95.00	95.00
No. 8 stranded	115.00	115.00
No. 6 stranded	160.00	160.00
No. 4 stranded	205.00	205.00
No. 2 stranded	266.00	266.00
No. 1 stranded	315.00	315.00

Twin-Conductor

No. 14 solid	104.00	104.00
No. 12 solid	135.00	135.00
No. 10 solid	185.00	185.00
No. 8 stranded	235.00	235.00
No. 6 stranded	370.00	370.00
No. 4 stranded	575.00	575.00

DISCOUNT PER 1000 FT.

Single-Conductor

	Chicago	N. Y.
No. 14 solid:		
Less than coil	+10%	+10%
Coil to 1000 ft.	—10%	3%
No. 12 solid:		
Less than coil	+10%	+10%
Coil to 1000 ft.	—10%	3%

Twin-Conductor

No. 14 solid:		
Less than coil	+10%	+10%
Coil to 1000 ft.	—13%	3%
No. 12 solid:		
Less than coil	+10%	10%
Coil to 1000 ft.	—10%	3%

ATTACHMENT PLUGS

	Std. Pkg.	List Chicago	List N. Y.
Benjamin No. 903	100	$0.25	$0.25
Hubbell No. 5406	250	.30	.30
Bryant No. 706	100	.25	.25
G. E. 50996	250	.22	.22
Discount		Chicago	N. Y.
Less than 1/5 std. pkg.:			
Benjamin No. 903		12%	12%
Hubbell No. 5406		+10%	+20%
Bryant No. 706		+20%	+20%
G. E. 50996		+20%	+20%
1/5 to std. pkg.:			
Benjamin No. 903		20%	20%
Hubbell No. 5406		—10%	20%
Bryant No. 706		Net	20%
G. E. 50996		Net	20%
Std. pkg.:			
Benjamin No. 903		44%	44%
Hubbell No. 5406		—34%	34%
Bryant No. 706		30%	34%
G. E. 50996		—30%	34%

BATTERIES, DRY

Each Net	No. 6 Regular Chicago	No. 6 Regular N. Y.	No. 6 Ignitor Chicago	No. 6 Ignitor N. Y.
Less than 12	$0.35	$0.35	$0.35	$0.35
12 to 50	.30	.30	.30	.30
50 to barrel	.255	.28	.265	.29
Barrel lots	.24	.24	.25	.25

CONDUIT, METALLIC FLEXIBLE

Size, In.	Feet per Coil	List per 100 Ft. Chicago	N. Y.
5/16	250	$5.00	$5.00
⅜	250	7.50	7.50
½	100	10.00	10.00
¾	50	13.00	13.00
1	50	21.00	21.00
1¼	50	26.00	26.00
1½	25-50	35.00	35.00
2	25-50	45.00	45.00
2½	25-50	52.00	52.00

CONDUIT, METALLIC FLEXIBLE—CONTINUED

	⅜" Single Strip Chicago	⅜" Single Strip N. Y.	⅜" Double Strip Chicago	⅜" Double Strip N. Y.
Less than coil per 1000 ft.	Net	Net	Net	Net
Cost to 1000 ft. per 1000 ft.	4%	4%	4%	4%
	½" Single Strip Chicago	½" Single Strip N. Y.	½" Double Strip Chicago	½" Double Strip N. Y.
Less than coil per 1000 ft., net	$100.00	$100.00	$105.00	$110.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, in.	List, per Foot Chicago	List, per Foot N. Y.	Size, in.	List, per Foot Chicago	List, per Foot N. Y.
7/32	$0.05½	$0.05½	1	$0.25	$0.25
¼	.06	.06	1¼	.33	.33
⅜	.09	.09	1½	.40	.40
½	.12	.12	1¾	.47	.47
⅝	.15	.15	2	.55	.55
¾	.18	.18	2¼	.65	.65

Per 1000 Ft. Net.	7/32 In. Chicago	7/32 In. N. Y.	¼ In. Chicago	¼ In. N. Y.
Less than $15.00 list	$55.00	$55.00	$60.00	$60.00
$15.00 to $60.00 list	27.50	24.50	30.00	27.00
$60.00 to $150.00 list	24.75	21.50	27.00	23.50

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

(*Card No.* 38)

Size, in.	Conduit, List per Foot Chicago	Conduit, List per Foot N. Y.
¼	$0.08½	$0.08½
⅜	.08½	.08½
½	.08½	.08½
¾	.11½	.11½
1	.17	.17
1¼	.23	.23
1½	.27½	.27½
2	.37	.37
2½	.58½	.58½
3	.76½	.76½

Size, in.	Couplings, List, Each Chicago	Couplings, List, Each N. Y.	Elbows, List, Each Chicago	Elbows, List, Each N. Y.
¼	$0.05	$0.05	$0.19	$0.19
⅜	.06	.06	.19	.19
½	.07	.07	.19	.19
¾	.10	.10	.25	.25
1	.13	.13	.37	.37
1¼	.17	.17	.45	.45
1½	.21	.21	.60	.60
2	.28	.28	1.10	1.10
2½	.40	.40	1.80	1.80
3	.60	.60	4.80	4.80
	Discount,		Discount,	
	¼ In. to ½ In. Chicago	¼ In. to ½ In. N. Y.	¾ In. to 3 In. Chicago	¾ In. to 3 In. N. Y.
Less than 2500 lb	3.8%	6%	6.8%	9%
2500 to 5000 lb	5.8%	8%	8.8%	11%

(For galvanized deduct six points from above discounts.)

FLATIRONS

	Chicago	N. Y.
List	$5.50	$5.00
Discount	30%	30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List Chicago	List N. Y.
3-amp. to 30-amp.	100	$0.25	$0.25
35-amp. to 60-amp.	100	.35	.35
65-amp. to 100-amp.	50	.90	.90
110-amp. to 200-amp.	25	2.00	2.00
225-amp. to 400-amp.	25	3.60	3.60
450-amp. to 600-amp.	10	5.50	5.50
600-Volt			
3-amp. to 30-amp.	100	$0.40	$0.40
35-amp. to 60-amp.	100	.60	.60
65-amp. to 100-amp.	50	1.50	1.50
110-amp. to 200-amp.	25	2.50	2.50
225-amp. to 200-amp.	25	5.50	5.50
450-amp. to 600-amp.	10	8.00	8.00

FUSES, INCLOSED—CONTINUED

Discount	Chicago	N. Y.
List	28%	28%
Discount	38%	38%

FUSE PLUGS

3-Amp. to 30-Amp.

Per 100 Net.	Chicago	N. Y.
Less than 1/5 std. pkg.	$6.25	$5.25
1/5 to std. pkg.	5.25	4.50

Standard package, 500. List, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each—Chicago	List, Each—N. Y.
10 to 40-watt—B	100	$0.27	$0.27
60-watt—B	100	.36	.36
100-watt—B	24	.65	.65
75-watt—C	50	.65	.65
100-watt—C	24	1.00	1.00
200-watt—C	24	2.00	2.00
300-watt—C	24	3.00	3.00
Round bulbs, 3½-in., frosted:			
15-watt—G 25	50	.50	.50
25-watt—G 25	50	.50	.50
40-watt—G 25	50	.50	.50
Round bulbs, 3¾-in., frosted:			
60-watt—G 30	24	.72	.72
Round bulbs, 4⅝-in., frosted:			
100-watt—G 35	24	1.05	1.05

Discount	Chicago	N. Y.
Less than std. pkg.	Net	Net
Std. pkg.	10%	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

	Per 1000 Ft. Net—Chicago	Per 1000 Ft. Net—N. Y.
Less than coil (250 ft.)	$37.52	$35.17
Coil to 1000 ft.	28.14	26.73

LAMP GUARDS, WIRE

Per 100 Net	Chicago	N. Y.
Less than 50, Matthews 16-cp	$20.00	$20.00
Less than 1/5 std. pkg. Hubbell	28.35	29.00
Less than 36, 60-watt Loxon	25.00	20.00

OUTLET BOXES

Union Cat. No.	Black, List, per 100—Chicago	Black, List, per 100—N. Y.
101	$30.00	$30.00
102	30.00	30.00
103	25.00	25.00
106	20.00	20.00

Union Cat. No.	Galv., List, per 100—Chicago	Galv., List, per 100—N. Y.
101	$30.00	$30.00
102	30.00	30.00
103	25.00	25.00
106	20.00	20.00

Discount	Black—Chicago	Black—N. Y.	Galvanized—Chicago	Galvanized—N. Y.
Less than $10.00 list	40%	List	35%	List
$10.00 to $50.00 list	50%	42%	45%	37%

PIPE FITTINGS

Condulets, V.V., Unilets and Similar

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.	10%	10%
1/5 to std. pkg.	20%	20%
Std. pkg.	30%	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

	Per 1000 Net—Chicago	Per 1000 Net—N. Y.
Less than 1/5 std. pkg.	$18.00	$20.00
1/5 to std. pkg.	13.00	15.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

	5½ N.C.—Solid Std. Pkg. 3500		Nail-it—N.C. Std. Pkg. 4000	
Per 1000 Net	Chicago	N. Y.	Chicago	N. Y.
Less than 1/5 std. pkg.	$18.00	$24.30	$28.00	.....
1/5 to std. pkg.	18.00	12.15	21.50	.....

SOCKETS AND RECEPTACLES

	Std. Pk.	List—Chicago	List—N. Y.
⅛-in. cap key socket	500	$0.33	$0.33
⅛-in. cap keyless socket	500	.30	.30
⅛-in. cap pull socket	250	.60	.60

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.	Net	Net
1/5 to std. pkg.	15%	20%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

Perkins or Trumbull Type A:	List—Chicago	List—N. Y.
30-amp. S. P. S. T.	$0.80	$0.80
60-amp. S. P. S. T.	1.20	1.20
100-amp. S. P. S. T.	2.25	2.25
200-amp. S. P. S. T.	3.48	3.48
300-amp. S. P. S. T.	5.34	5.34
30-amp. D. P. S. T.	1.20	1.20
60-amp. D. P. S. T.	1.78	1.78
100-amp. D. P. S. T.	3.38	3.38
200-amp. D. P. S. T.	5.20	5.20
300-amp. D. P. S. T.	8.00	8.00
30-amp. 3 P. S. T.	1.80	1.80
60-amp. 3 P. S. T.	2.68	2.68
100-amp. 3 P. S. T.	5.08	5.08
200-amp. 3 P. S. T.	7.80	7.80
300-amp. 3 P. S. T.	12.00	12.00
Perkins Type B or Trumbull Type C:		
30-amp. S. P. S. T.	0.42	0.42
60-amp. S. P. S. T.	0.74	0.74
100-amp. S. P. S. T.	1.50	1.50
200-amp. S. P. S. T.	2.70	2.70
30-amp. D. P. S. T.	0.68	0.68
60-amp. D. P. S. T.	1.22	1.22
100-amp. D. P. S. T.	2.50	2.50
200-amp. D. P. S. T.	4.50	4.50
30-amp. 3 P. S. T.	1.02	1.02
60-amp. 3 P. S. T.	1.84	1.84
100-amp. 3 P. S. T.	3.76	3.76
200-amp. 3 P. S. T.	6.76	6.76

DISCOUNT

Type A, Perkins or Trumbull:	Chicago	N. Y.
Less than $10 list	Net	Net
$10 to $25 list	15%	15%
$25 to $50 list	18%	18%
Type B, Perkins, or Type C, Trumbull:		
Less than $10 list	10%	10%
$10 to $25 list	20%	20%
$25 to $50 list	28%	28%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List—Chicago	List—N. Y.
5-amp. single-pole	250	$0.28	$0.28
5-amp. single-pole, ind.	250	.32	.32
10-amp. single-pole	100	.48	.48
10-amp. single-pole, ind.	100	.54	.54
5-amp., three-point	100	.56	.56
10-amp., three-point	50	.76	.76
10-amp., 250-volt, D. P.	100	66	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List—Chicago	List—N. Y.
10-amp. single-pole	100	$0.45	$0.45
10-amp. three-way	50	.70	.70
10-amp. double-pole	50	.70	.70

Discount	Chicago	N. Y.
Less than 1/5 std. pkg.	+20%	Net
1/5 to std. pkg.	Net	15%
Std. pkg.	30%	28%

SWITCH BOXES, SECTIONAL CONDUIT

C. F. Mfg. Co.	List, Each—Chicago	List, Each—N. Y.
No. 155	$0.34	$0.34
No. 160	0.60	0.60

Discount	Black—Chicago	Black—N. Y.	Galvanized—Chicago	Galvanized—N. Y.
Less than $2.00 list	25%	Net	15%	Net
$2.00 to $10.00 list	25%	50%	15%	40%
$10.00 to $50.00 list	35%	60%	25%	52%

TOASTERS, UPRIGHT

	Chicago	N. Y.
List	$5.00	$5.00
Discount	30%	30%

WIRE, ANNUNCIATOR

Per Lb. Net	Chicago	N. Y.
No. 18, less than full spools	$0.65	$0.62
No. 18, full spools	0.55	0.53

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

	Price per 1000 Ft. Net—Less than 500 Ft.		500 to 1000 Ft.		1000 to 5000 Ft.	
No.	Chicago	N. Y.	Chicago	N. Y.	Chicago	N. Y.
14	$18.00	$18.00	$16.00	$14.50	$14.00	$12.50
12	29.89	27.05	25.62	22.85	21.35	20.95
10	41.51	39.27	35.58	33.66	29.65	24.68
8	60.13	51.44	51.54	48.42	42.95	33.51
—	82.20	89.57	75.35	76.80	68.50	50.63

WIRE, WEATHER-PROOF

Solid-Conductor, Triple-Braid, Sizes 4/0 to 8. Inc.

	Per 100 Lb. Net—Chicago	Per 100 Lb. Net—N. Y.
Less than 25 lb.	$45.00	$40.25
25 to 50 lb.	44.00	39.25
50 to 100 lb.	43.00	38.25

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Entrance Fitting

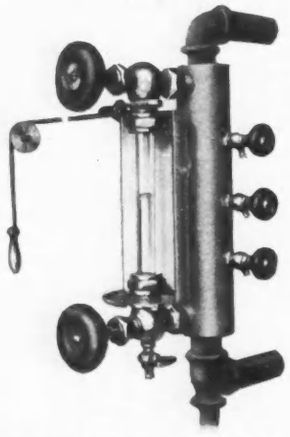
Service entrance L's that are weatherproof and do not require a gasket have been developed by the Adapti Company of Cleveland, Ohio. Attention is called to the fact that this fitting allows the conduit to lie close

SERVICE-ENTRANCE L

against the side of the buildings and not some distance away, as is generally the case. The cover is held in position by a screw and an overlapping flange on the fitting. These fittings are for use with conduit from ½ in. to 1¼ in. (1.27 cm. to 3.17 cm.) in diameter.

Gage Glass Guard

A water-gage guard that consists of a semi-cylindrical sheet-metal shutter, which can be rotated about the gage tube as an axis has been developed by the Simplex Safety Boiler Gauge Glass Company at Springfield, Mass. To the shutter is attached a piece of lamp cord which passes through an eye on the outer periphery of the upper circular tracks and from there extends to any point within convenient reach of the

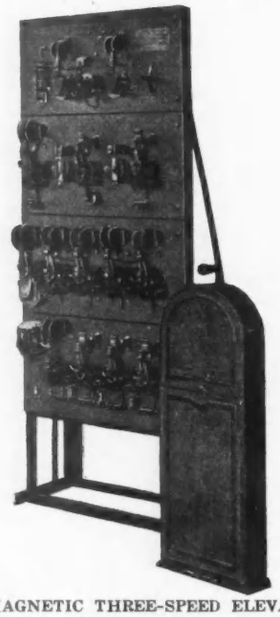


WATER-GAGE GLASS GUARD

fireman. When a gage glass breaks, the cord may be pulled and the circular shutter moved through half a turn, thereby deflecting the escaping steam and making it possible to shut off the valves on the gage cocks without danger of being burned, it is claimed. When this has been done the shutter may be removed from its tracks to permit replacing the broken gage tube by moving the shutter another quarter turn.

Elevator Control Equipment

Magnetic three-speed elevator controllers that govern the reversal and speed control of elevator motors have been developed by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. No more current than is necessary to hoist the maximum load is permitted by this apparatus, thus protecting the motor against injury due to excessive currents. When the elevator which is controlled approaches the top and bottom limits of its travel it is automatically slowed down and



A MAGNETIC THREE-SPEED ELEVATOR CONTROLLER

smoothly brought to rest. The design and arrangement of connections are such that no combination of grounds or short circuits can cause the car to run into the overhead beams or into the pit, it is claimed. Provisions are made so that the occurrence of slack in the hoisting cable will immediately stop the car. An overspeed governor with a safety guide grip is employed so that should the car run over its rated speed of 400 ft. per minute (133 m. per minute) the current to the motor will be interrupted and the guide grips will act to stop the car immediately. Two magnetically operated brakes are mounted on the hoisting machine, one for braking the drum shaft and the other for the motor shaft.

Household Iron

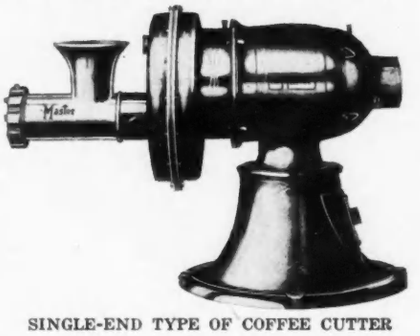
The Western Electric Company of New York City has developed a 6½-lb. (2.7-kg.) electric iron for household purposes in which every part is a complete unit, made so as to be interchangeable. Attention is called to several features of this iron. It has a black and white cord in which the conductors are stranded, not braided, producing a long-wearing flexible cord. The pressure plate holds the heating element firmly against the bottom of the iron, keeping the heat distributed where it will be most effective. The heating element is made of chromium-nickel ribbon, and the contact pins, which are easy to replace, of non-corroding German silver. A separable two-piece socket plug is furnished.

Switch and Cut-Out

Quick-break safety switches and cutouts, constructed so as to prevent accidental contact with current-carrying parts, are manufactured by the Palmer Electric & Manufacturing Company of Boston, Mass. The apparatus is designed so that no live parts are exposed when the switch is being operated or when the cutout is being re-fused. This feature is assured by a sliding shutter which is mounted on the main box cover and interlocked with the switch handle. When the fuse chamber is open the switch is locked open and when the switch is closed the fuse chamber is locked closed.

Coffee Cutters

Coffee-cutting machines operated by totally inclosed, low-speed Westinghouse motors designed for heavy duty and having no complicated mechanism



SINGLE-END TYPE OF COFFEE CUTTER

to need adjustment are manufactured by the Master Cutter Machine Company of Cincinnati, Ohio. Owing to the fact that a low-speed motor is employed no gears are necessary. The motors are equipped with radial and thrust ball

bearings which minimize friction and prevent wabbling of parts. The only parts needing lubrication are the ball bearings, and these only once a year. Thus there is no oil to accumulate in the burr case, none to get into the coffee, and all the nuisance of oiling is removed.

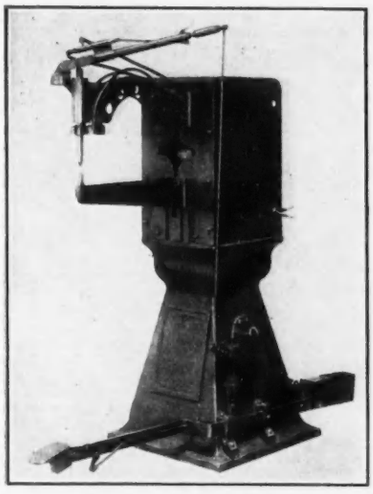
This line of cutters consists of single-end and double-end styles and a "three-in-one" machine which besides granulating and pulverizing the coffee can be used for chopping meat. The single-end machines are made in two sizes and are of sufficient capacity for most stores.

Pipe Straps

The Central Distributing Company of Detroit, Mich., has brought out a complete line of lead-covered pipe straps in sizes of from ¼ in. to 4 in. (0.64 cm. to 10.2 cm.) inclusive. These straps are not affected by acids, atmospheric conditions, lime, etc., it is claimed. Weights for the different sizes have been adopted so that the line throughout is uniform in strength for the work required. These standards insure that the customer will get the same weight and size strap at all times.

Spot Welder

Spot welders made in two standard types of various ratings are manufactured by the Pacific Electric Welder & Manufacturing Company of Seattle, Wash. One of the types is adapted to work on clean stock measuring thirty-gage to eleven-gage while the other is for thirty-gage to three-gage material. The largest opening between points on these machines is 3½ in. (8.9 cm.). The distance between the upper arm and the lower horn is 7 in. to 15 in. (17.8 cm. to 38.1 cm.). The machines are equipped with hollow welding points



ELECTRIC SPOT WELDER

through which water is allowed to circulate to keep them cool and increase the life of the points. To use the apparatus the material to be welded is placed between the electrodes or welding points and pressure applied thereto either with the hand or foot lever, thus completing the circuit and heating the metal to the welding temperature.

Immersion Heater

The Russell Electric Company has placed upon the market an immersion heater the inclosing tube of which is made of a heavily nickel-plated brass tube. In this unit a brass tube has been used instead of the usual steel or aluminum, since it has been found that steel rusts and aluminum, if operated in the open, will melt. The tube is 3/16 in. (0.48 cm.) in diameter, 6 in. (15.2 cm.) long, and contains an element rated at 250 watts. It is claimed that this device will in one minute heat a glassful of water as hot as it can be drunk and will boil a glassful of water in three minutes. The cord is detachable at the unit.

Electric Stove

In the accompanying illustration is shown an electric stove, the baking capacity of the upper oven of which can be increased 50 per cent without increasing the maximum demand of the range. This stove is a product of the S-P Stove Company of Wilmette, Ill. It has four outside top burners, 8-in (20.3 cm.) in diameter and of 900 watts each, maximum demand. It also has one inside lower oven burner, 8 in. (20.3 cm.) in diameter, with a maximum demand for boiling or roasting of 660 watts. In the upper oven, which is suitable for all kinds of baking, are three adjustable and removable square burners rated at 550 watts each. The size of the oven is 15 in. by 16 in. by 12 in. (38.1 cm. by 40.6 cm. by 30.5 cm.) The splashers, back, oven side and door panels are white-enameled.

RANGE WITH FOUR OUTSIDE BURNERS AND TWO OVEN BURNERS

Drink Mixer

The Wisconsin Electric Company, in conjunction with Horlick's Malted Milk Company, both of Racine, Wis., has placed an improved drink mixer on the market. The entire base and column is finished in white porcelain enamel. The motor which drives the mixing spindle is stationary on the head of the column, only the mixing spindle moving up and down. The spindle is light and the mixer is very easily operated.

RAPID DRINK MIXER

The current is automatically turned on when the spindle engages with the driving disk on the motor and is shut off instantly when the spindle is raised. Another advantage of the mixer is that the spindle rises to a height of 7.5 in. (19.05 cm.), enabling the largest container or mixing glass to be set under the spindle without tipping the container.

Window Reflector

A glare-reducing reflector for exposed windows such as island, open, or mirrored-backed, narrow-entrance windows, etc., is the latest addition to the Holophane line of prismatic reflectors produced by the Glass Company, Inc., New York City. The reflector consists of a special asymmetric prismatic reflector with an annular prismatic plate over the front half of the opening. The plate is held in place by a U-shape steel band that engages a flange on half of the circumference of the reflector. The edge of the reflector is recessed, so that the plate has a positive position. This makes the assembling easy. The ring is fitted to the plate, placed in position and sprung over the flange of the reflector. Sufficient room has been provided for inserting the lamp without removing the plate.

The addition of a refracting plate is an innovation in window-lighting reflectors, and the advantages claimed for it are that it shields the eye from the bright lamp filament and at the same time increases the efficiency by reflecting the light down into the window that would otherwise escape at high angles and cause glare.

The reflectors, which are 10 in. (25.4 cm.) in diameter and 6⅞ in. (17.4 cm.) high, are designed for standard 2¼-in. (5.7-cm.) holders with the 100-watt type C or C2 lamps. The maximum intensity of light is delivered at about 27 deg. from the vertical. Practically all of the light is delivered in useful directions for lighting the goods, while a small amount is directed upward for brightening the top of the window and lighting valances and transparencies.

Trade Publications

IRONS.—The Western Electric Company of New York City is mailing an illustrated folder descriptive of its No. 1 iron.

PAINT.—"Red Lead and How to Use It" is the title of a book published by A. H. Sabin, 111 Broadway, New York City.

FIXTURES.—Samuel Frost of 304 Bowery, New York City, is distributing a folder descriptive of complete house-lighting sets.

FUSES.—The Chicago Fuse Manufacturing Company of Chicago has prepared a bulletin descriptive of auto fuses, contact clips, cut-outs and boxes.

MOTORS.—Bulletin No. 511, descriptive of ball-bearing, splash-proof washing-machine motors, has been prepared by the Domestic Electric Company of Cleveland, Ohio.

HARD RUBBER.—The B. F. Goodrich Company of Akron, Ohio, has prepared a bulletin descriptive of its hard-rubber goods for battery jars, tires, tubes, insulated wire, etc.

BATTERIES.—The Electric Storage Battery Company of Philadelphia is distributing a folder descriptive of its new eight-story building now in the course of construction.

REFLECTORS.—The National X-Ray Reflector Company of Chicago is distributing a temporary catalog page for catalog 19. This page describes X-ray floodlighting projectors.

CHAIN DRIVE.—The Link-Belt Company of Chicago is distributing a decorated folder on which a section of the President's proclamation is given. A copy of the folder will be sent to any one applying for it.

POWER MACHINERY.—MacGovern & Company of 114 Liberty Street, New York City, have prepared a catalog on electrical, hydraulic, steam and gas machinery. Contractors' equipment is also included in this catalog.

PROTECTIVE PREPARATION—The McGraw Company of Omaha, Neb., is distributing a leaflet descriptive of "Neutraline," designed particularly for protection of the skin against sulphuric acid, such as is used in storage batteries.

MOTOR PUMPS.—The Hawkeye motor pump, an automatic pump to take the place of water lifts and for use with open tanks or pressure tanks, is described and illustrated in a bulletin prepared by the Chandler Pump Company of Cedar Rapids, Iowa.

CHAIN DRIVE.—The Link-Belt Company of Chicago, Ill., is distributing a booklet entitled "Ideal Drive for Cement Mill Equipment." This book describes the operating cement machinery at the plant of the Nazareth Cement Company, Nazareth, Pa.

GENERATORS. — The Crocker-Wheeler Company, Ampere, N. J., has prepared bulletin No. 178, descriptive of its three-wire generators. This company is also distributing bulletin No. 177, descriptive of its form W rolling-mill motors, 220 or 230 volts, direct-current, sizes 6.5 hp. to 200 hp.

ELECTRIC TOOLS.—The Stow Manufacturing Company of Binghamton, N. Y., is distributing bulletin No. 101, descriptive of its portable electric tools, electric motors and special machines. This company is also distributing bulletin No. 102, descriptive of flexible shaftings. These are miniature copies and are very complete.

SAWMILL SUPPLIES.—Link belt and sprocket wheels for sawmills are described and illustrated in book No. 260, now being distributed by the Link-Belt Company of Chicago, Ill. This booklet describes those classes of link belts most commonly used in sawmills, and presents only a few of the many types this company can supply.

CHAINS.—The Link-Belt Company of Chicago has prepared book No. 125, which is descriptive of the link-belt style of chain for efficient transmission of power. This data book takes into consideration the various uses of these chains and the method of using them. List prices are also given in this book. The data forms contained in the book will present the facts in such a way as to render "checking up" easy. The book is well illustrated and has been prepared with care.

ELECTRIC FURNACES.—The Society for Electrical Development, Inc., New York City, is publishing a book entitled "Industrial Heating as a Central Station Load." The object of this publication is to give in compact form for ready reference facts and data on the various uses and applications of commercial electric heating as practised in the United States to-day. The data include both the high-temperature furnaces of the metal industries and those various forms of electric heaters which have already found wide application in large and varied industrial fields.

ROTARY CONVERTERS. — Siemens Brothers Dynamo Works, Ltd., Palace Place Mansions, Kensington Court, London, W. S., have issued a new pamphlet dealing with rotary converters. The pamphlet contains not only a description of this company's machines, but also a certain amount of information of a general nature in regard to rotary converters. Special attention is drawn to the section which deals with the control of voltage on rotary converters, and which is intended to convey to the reader an appreciation on the one hand of the capabilities and on the other of the limitations of this type of plant.

New Incorporations

THE AMERICAN INSULATION COMPANY of Philadelphia, Pa., has been incorporated with a capital stock of $100,000 by B. T. Conwell, Jr., and associates.

THE OSBORNE (PA.) ELECTRIC LIGHT COMPANY has been chartered with a capital stock of $5,000 by E. S. Haymond of Wilkinsburg, Pa., and others to operate in Osborne.

THE GREAT LAKES ELECTRIC MANUFACTURING COMPANY of Chicago, Ill., has been chartered with a capital stock of $25,000 by G. A. Johnson, George A. Chritton and C. C. Becker.

THE ROTARY SCRAPER COMPANY of New York, N. Y., has been chartered with a capital stock of $10,000 to do general electrical work and deal in rotary brushes, scrapers and other devices.

THE ELECTRIC SERVICE COMPANY of Beaver Falls, Pa., has been incorporated with a capital stock of $5,000 by Walter P. Rice, Constantine J. Freund and Robert Cunningham of Beaver Falls.

THE LEETSDALE (PA.) ELECTRIC COMPANY has been chartered with a capital stock of $5,000 to furnish electricity in Leetsdale. E. S. Haymond of Wilkinsburg, Pa., is interested in the company.

THE MOON (PA.) TOWNSHIP LIGHT COMPANY has been incorporated with a capital stock of $5,000 by E. S. Haymond of Wilkinsburg, Pa., and others. The company proposes to operate in Moon Township.

THE SEWICKLEY (PA.) ELECTRIC LIGHT COMPANY has been granted a charter with a capital stock of $5,000 to operate in Sewickley. E. S. Haymond of Wilkinsburg, Pa., is interested in the company.

THE ALEPPO (PA.) TOWNSHIP ELECTRIC COMPANY has been incorporated with a capital stock of $5,000 to operate in Aleppo Township. E. S. Haymond of Wilkinsburg, Pa., is interested in the company.

THE FAN-FLAME SPARK PLUG COMPANY of Yonkers, N. Y., has been chartered with a capital stock of $15,000 by Lura B. Galbraith, Bowman B. Tottingham and John J. Gill. The company proposes to manufacture spark plugs.

THE GUY V. WILLIAMS COMPANY of New York, N. Y., has been incorporated with a capital stock of $15,000 to deal in electric lamps, chandeliers, wires, etc., by Guy V. Williams, H. H. Williams and Thomas Cole, 116 Broad Street, New York City.

THE OZONE-AQUA ELECTRIC HEATER CORPORATION of New York, N. Y., has been incorporated by John J. Von Hentzel, Dr. Alfred Starr and Dr. B. W. Kirschner. The company is capitalized at $100,000 and proposes to manufacture electric appliances.

THE KEYSTONE ELECTRICAL APPLIANCE COMPANY of Philadelphia, Pa., has been incorporated by Stephen D. Large, C. C. Davis and Horace S. Jones, all of Philadelphia. The company is capitalized at $5,000 and proposes to manufacture electrical switches, etc.

THE EUREKA BOAT & AIRPLANE BUILDING CORPORATION of New York, N. Y., has been incorporated by Albert H. Morris, George W. Wagner and Adam Finck. The company is capitalized at $10,000 and proposes to manufacture boats, airplanes and dynamos.

THE EQUITABLE LIGHT, HEAT & POWER COMPANY has been incorporated with a capital stock of $5,000 to operate in Kimmel Township by D. E. Brumbaugh of Claysburg, Pa., and W. H. Rohm and John H. Zinn of Osterburg, Pa. The office of the company will be in Queen.

THE BIRCHER COMPANY of Rochester, N. Y., has been incorporated by E. A. Bircher, H. W. Rippey of Rochester, N. Y., and J. B. Abbott of Geneseo. The company is capitalized at $30,000 and proposes to manufacture mechanical and electrical apparatus, office specialties, etc.

THE NITROGEN ELECTRIC COMPANY of Newark, N. J., has been chartered by Eugene A. Eppstein, 38 Spring Street; Albert F. Jacques and Rudolph H. Amberg, all of Newark, N. J. The company is capitalized at $15,000 and proposes to manufacture electric lamps.

THE ESSANKAY ELECTRIC & NOVELTY COMPANY of New York, N. Y., has been incorporated by J. S. Cumming, M. F. Slupsky and H. Knoch, 540 West 112th Street, New York City. The company is capitalized at $10,000 and proposes to do a general electrical contracting business and to manufacture novelties.

THE ZIOLA MANUFACTURING COMPANY of Milwaukee, Wis., has been incorporated with a capital stock of $20,000 to manufacture electrical devices, including X-ray machines and electro-therapeutic apparatus. The incorporators are: H. A. Ziola of Madison, Wis.; Dr. Theodore H. Rolfs and E. W. Bentzien.

THE UNITED STATES FUSE CORPORATION of Buffalo, N. Y., has been incorporated with a capital stock of $500,000 to manufacture electric fuses, appliances and devices. The incorporators are: H. H. Baker, 52 Oxford Avenue; J. W. Charters, 540 Walden Avenue, and C. F. Booth, 52 Woodward Avenue, Buffalo, N. Y.

THE NEW HYDRAULIC MACHINERY COMPANY of Montreal, Que., has been incorporated by George R. Drennan, Alexander G. Yeoman, Herbert W. Jackson, Francis G. Bush and others. The company is capitalized at $200,000 and proposes to manufacture hydraulic presses, pumps, accumulators, paper mill machinery, etc.

Trade Notes

THE MONITOR CONTROLLER COMPANY of Baltimore announces that E. Wesley Vaughan has joined the sales organization of its New York office.

KELLOGG BIRDSEYE has resigned as treasurer and general manager of the George C. Lynch Company, manufacturer of electric lamps, 236 Fifth Avenue, New York.

THE WESTERN ELECTRIC COMPANY has recently moved the general offices of its Seattle (Wash.) branch from 907 First Avenue to 84 Marion Street, where it will occupy a two-story brick structure erected especially for the concern.

THE RADIUM LUMINOUS MATERIALS CORPORATION, manufacturer of radium lighting devices, 123 North Third Street, Newark, will erect a two-story plant at 154 Alden Street, Orange, N. J. The new structure is estimated to cost about $12,000.

J. H. RISSER, who has been manager of the central-station department of the Globe Stove & Range Company, Kokomo, Ind., has been appointed manager of electric sales with full and complete charge of the company's future electric-range development work.

THE PACKARD ELECTRIC COMPANY, Warren, Ohio, has established a district office on the fourth floor of the San Fernando Building, Los Angeles, Cal., in charge of J. G. Monahan, district manager. This office will handle southern California—from Fresno south—and the State of Arizona on all products of the company's transformer department.

GEAR MANUFACTURERS' CONVENTION.—The recently organized American Gear Manufacturers' Association held its first convention at the Hotel Schenley, Pittsburgh, Pa., on May 14 and 15. S. L. Nicholson, sales manager of the Westinghouse Electric & Manufacturing Company, spoke on "The Ins and Outs of an Industrial Organization," James E. Gleason presented a paper on "The Spiral or Curved-Tooth Bevel Gear," Frank Burgess a paper on "Job Gearing—To What Extent Can It Be Standardized?" and William Ganschow a paper on "Advantages of Gear Standardization." George L. Markland discussed the "Difficulties of Gear Standardization." The delegates visited the works of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, where they saw methods of manufacturing Bakelite micarta for gears, after which they were the guests of the Westinghouse company at a dinner in the club rooms of the Pittsburgh Athletic Association.

New England States

BRIDGTON, ME.—The Western Maine Power Company, which recently took over the plant of the Bridgton Water & Electric Company, will soon erect a transmission line to connect the local plant with the transmission lines of the Cumberland County Power & Light Company.

FORT FAIRFIELD, ME.—The Limestone (Me.) Light & Power Company, represented by Aubrey C. Frost of Limestone has petitioned the Public Utilities Commission for authority to furnish electricity in certain portions of the town of Fort Fairfield.

BOSTON, MASS.—An agreement has been reached between the city officials and the insurance men whereby a relatively small high-pressure-service pumping station will be built as soon as possible under the Copp's Hill burial grounds and that a few years hence another small station will be erected on the Charles River Esplanade. Plans have already been prepared for the Copp's Hill station which provide for a capacity of 13,000 gal. per minute, to cost about $165,000. It will be operated by electricity furnished from the power house of the Boston Elevated Company, with arrangements for a reserve supply from the Edison Electric Illuminating Company. The entire cost of the work, including station, laying additional water mains, etc., is estimated at about $1,000,000.

HOLYOKE, MASS. — The contract for the construction of the new power house for the Valley Paper Company has been awarded to the P. K. Kennedy Company. The new building will be equipped with modern power plant machinery.

SPRINGFIELD, MASS.—A permit has been granted for the erection of a new substation for the Springfield Street Railway Company, to cost about $30,000.

WESTFIELD, MASS. — Arrangements have been made for erecting electric lamps along Frederick Street.

PROVIDENCE, R. I.—The Narragansett Electric Light Company has applied to the City Council for permission to place manholes and conduits in Second Street.

Middle Atlantic States

ALBANY, N. Y.—Preliminary plans are being prepared by the J. G. White Engineering Corporation, 43 Exchange Place, New York City, for the construction of a hydroelectric power plant for the Albany Southern Railroad Company of Albany, to be located in the Catskill Mountains, to cost about $3,000,000.

BEACON, N. Y.—Bids will be received by James M. Carter, superintendent of prisons, Capitol, Albany, until June 12 for construction, heating, plumbing and drainage and electric work for the new dining room and kitchen for women's group at the Matteawan State Hospital, Beacon, N. Y. Drawings and specifications may be consulted at the Matteawan State Hospital, Beacon; at the New York office of the Department of Architecture, 1224 Woolworth Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

BAYONNE, N. J.—Bids will be received by the Board of Education of Bayonne until June 14 for construction of new public school building, including electrical work, heating and ventilating, etc., to be erected on Avenue B near Forty-seventh Street. D. G. Anderson, Avenue E and Thirtieth Street, is architect. James D. Boyd is secretary of board.

NEWARK, N. J.—Preparations are being made by Victor A. Rohner of Newark to establish an electrical repair plant to work on generators, motors, armatures, etc.

NEWARK, N. J.—Bids will be received by the Board of Education, City Hall, Newark, until June 11 for electrical work, heating and ventilating, pipe covering and smoke breeching for various school buildings. R. D. Argue is secretary.

NEWARK, N. J.—Bids will be received by the Board of Freeholders until June 6 for coal and ash-handling equipment and steamfitting at the boiler plant at Overbrook Hospital. Runyon & Carey, 845 Broad Street, Newark, N. J., are consulting engineers.

NEWARK, N. J.—The Board of Freeholders has awarded the contract for new generator, engine and switchboard panels at the power plant of the Caldwell penitentiary to the Watson Flagg Engineering Company, 27 Thames Street, New York, at $9,500, and for boiler equipment to the Salmon Heating & Contracting Company, 259 New York Avenue, Newark, at $16,789.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

NEWARK, N. J.—Bids will be received by the Passaic Valley Sewerage Commissioners, 31 Clinton Street, Newark, N. J., until June 19 for electric equipment for the Newark Bay pumping station, including three 60-kva., two-phase, 60-cycle, 220-volt alternating-current generators directly connected to and mounted on the same bases with vertical compound steam engines with automatic lubrication, operating at 150-lb. gage pressure and 26-in. vacuum; also for a directly connected exciter for each set, with generator and feeder switchboard panels, field rheostat and auto-transformers for 220/110-volt lighting service, with electrical connections, steam supply, exhaust piping, etc. J. H. Quigg is clerk of commission.

PLAINFIELD, N. J.—Contract has been awarded by the Niles-Bement-Pond Company for the erection of a two-story, 85-ft. by 125-ft. addition to plant, to be used as an office building. The company, it is reported, has purchased equipment for a power plant which will be built later on.

HARRISBURG, PA.—Bids will be received by the Department of Safety until June 4 for municipal lighting throughout the city, including streets, city buildings, filter plant, pumping plant, etc., for a period of five years. The plans call for 350-watt magnetite electric arc lamps or incandescent lamps of 60 cp. or 100 cp.

TITUSVILLE, PA.—Bids will be received by the city of Titusville until June 4 for furnishing and installing one 3,000,000-gal. pump at the city water works, driven by gas or oil engine power. Specifications may be obtained from Karl R. Kightlinger, city engineer.

BALTIMORE, MD.—The City Electrical Commission is contemplating extensive additions to the municipal underground conduit system during the present year. Raleigh C. Thomas is chief engineer.

MORGANTOWN, W. VA.—Orders have been placed by the West Virginia Traction & Electric Company for four Taylor stokers for its local power house. Two of these stokers will be installed under the new 500-hp. boilers now being erected and the other two will be installed under the present gas-fired boilers, for these boilers can be operated with coal at a higher rating than at present.

ROANOKE, VA.—The Roanoke Railway & Electric Company is rebuilding its Walnut Street power station, at a cost of about $300 000. The output of the plant will be increased from 6000 hp. to 19,075 hp.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 28, for furnishing the various federal buildings, marine hospitals and quarantine stations under the control of the Treasury Department, portable desk lamps during the fiscal year ending June 30, 1918. For details see proposal columns.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Washington, D. C., Schedule 1184—miscellaneous electrical equipment; rammers, powder hoists, shell hoists, etc.; Schedule 1182—400 each high-resistance and non-adjustable type, radio-head receivers with cord; Schedule 1168—three 2-ton battery crane trucks. Philadelphia, Pa., and Norfolk, Va., Schedule 1186—furnishing and installing complete 14 furnaces and blowers. St. Juliens Creek (Norfolk) Va., Schedule 1164—two Diesel-engine-driven generating sets. New York, N. Y., or Mare Island, Cal., Schedule 1171—one motor truck. Mare Island, Cal., Schedule 1179—19,030 lb. admiralty metal condenser tubes, 3040 lb. sheet condenser tube. Boston, Mass., Schedule 1167—one motor-driven hobbing machine for worm wheels. Applications for proposals should designate the schedule desired by number.

North Central States

PORT HURON, MICH.—The City Commission has awarded the Port Huron Gas & Electric Company a contract for lighting the streets of the city for a period of seven years, under the terms of which the company will install a new street-lighting system. The contract provides for 152 lamps of 600 cp., 89 lamps of 400 cp. and 36 lamps of 100 cp.

BARBERTON, OHIO.—The City Council has adopted an ordinance providing for an issue of $50,000 in bonds for additions to the municipal electric power plant, including the installation of additional machinery and an extension to the power house.

CINCINNATI, OHIO.—The Diem & Wing Company of Cincinnati is planning to erect an addition to its plant on Eggleston Avenue, most of which will be used as a power plant.

CINCINNATI, OHIO.—Application has been made by the Charles Boldt Company for a permit to erect a power plant and a sorting room addition to its new paper plant now under construction.

CLEVELAND, OHIO.—Plans are being prepared by William R. McCormack, architect of board of education, for a power house for the Norwood School, to cost about $50,000.

CLEVELAND, OHIO.—The State Utilities Commission has granted the Cleveland Electric Illuminating Company permission to issue $2,000,000 in bonds, the proceeds to be used for improvements.

GUNNERSVILLE, OHIO. — Right of way has been secured by the Dayton Power & Light Company of Toledo for the erection of an electric transmission line from Xenia to Gunnersville, a distance of 15 miles.

ST. MARYS, OHIO.—Contracts have been awarded by the Board of Control for the construction of the municipal electric-light and water-works plant and distribution system, including ornamental street lamps, to the Skeldon Engineering Company and the National Supply Company of Toledo, and Charles I. Zahm of Detroit, Mich. The cost of the work will be about $47,000.

YOUNGSTOWN, OHIO.—The Mahoning & Shenango Railway & Light Company of Youngstown is erecting a new electric transmission line from Lowellville to Masury. Work has begun on the construction of a large outdoor substation at Masury at which the line will terminate.

YOUNGSTOWN, OHIO.—Contract has been closed by the Brier Hill Steel Company with the Mahoning & Shenango Railway & Light Company for energy to operate its two plate mills, soon to be erected. The mills will be equipped throughout for electrical operation. The electrical equipment will include a number of motors of several thousand horse power each, and also one or two motor-generator sets with a rating of 1500 hp. each. The contract calls for 10,000 hp.

HARDINSBURG, KY.—The Hardinsburg Electric Light Company, recently organized, contemplates the construction of an electric plant here. Alfred Taylor and others are interested.

LA GRANGE, KY.—The Kentucky Utilities Company of Lexington is reported to have offered to purchase an electric light and power franchise and to enter into a contract for street lighting. Service is to be established on or before Dec. 1, 1917.

WHITESBURG, KY.—The Whitesburg Electric Light Company, recently organized by W. C. Daniels and others of Monica, is planning to erect electric transmission lines to nearby coal-mining plants. Work will be started at once on erection of the line.

KENDALLVILLE, IND.—Bids will be received by the Common Council of Kendallville, Ind., until June 12, for improvements to waterworks system, including the construction of a 500,000-gal. reinforced concrete reservoir, 40 ft. by 85 ft. by 20 ft.; one motor-driven, low-service centrifugal pump, 400-gal. per minute capacity; one motor-driven fire service centrifugal pump, 1000-gal. capacity per minute, with pipings, valves and fittings. George Champe of Toledo, Ohio, is civil engineer.

MARTINSVILLE, IND. — The power house of the municipal water-works system was recently destroyed by fire, causing a loss of about $25,000.

ROCHESTER, IND.—The Council has appropriated $8,000 to purchase a turbine pump with electric auxiliary for the municipal water-works system.

TIPTON, IND.—The plant of the H. Clauss Manufacturing Company, which was recently destroyed by fire, is being rebuilt. The plant will be equipped throughout with electrically operated machinery. Energy will be obtained from the municipal electric plant.

CALUMET, ILL.—Bids will be received by the clerk of the Sanitary District of Chicago, Room 700, Karpen Building, 910 South Michigan Boulevard, Chicago, until June 28, for furnishing and erecting equipment at the Calumet sewage pumping station as follows: (A) For six vertical centrifugal pumps of nominal capacity, one at

50 c.f.s., two at 75 c.f.s., and three at 275 c.f.s.; (B) three vertical synchronous induction motors and three vertical induction motors (prime movers for above pumps); (C) two turbo-generator units with acessories of nominal capacity of 3000 kw. each; (D) eight water-tube boilers with furnaces, chain-grate stokers, steam superheaters, and soot blowers of nominal rating of 500 hp. each. John McGillen is clerk of board.

GIBSON CITY, ILL.—Plans are being considered by the City Council for the installation of a municipal electric light plant, to cost about $22,000, for which bonds have been authorized.

LINCOLN, ILL.—Bids are being asked by the City Commissioners for the installation of an ornamental lighting system on Lincoln and Wyatt Avenues. At an election to be held June 19 the proposal as to whether the city will acquire and operate the Lincoln Street Railway and issue $30,000 in bonds for same will be submitted to the voters.

BIRNAMWOOD, WIS.—The Charles W. Fish Lumber Company of Birnamwood, it is reported, will soon be ready for bids for construction of a power plant, 35 ft. by 115 ft., and steam generating equipment.

SCHLEISINGERVILLE, WIS. — The transmission line from the village of Schleisingerville to Hartford is reported to have been purchased by the Milwaukee Electric Railway & Light Company, which is extending its system in this section.

WEST MILWAUKEE, WIS.—A special election will be called to submit to the voters the proposal to install an electric street-lighting system in the village. An estimated cost of a system has been prepared by Arthur J. Sweet, consulting engineer.

ST. PAUL, MINN.—Improvements are being made to the plant of the St. Paul Foundry Company, involving an expenditure of about $1,000,000. Several fireproof buildings have been erected and new equipment and electrical apparatus will be installed.

CENTERVILLE, IOWA.—The Centerville Light & Traction Company, which has purchased a number of small electric operating companies in the vicinity of Centerville, contemplates the erection of 13,200-volt transmission lines to connect these plants with its central power station.

DES MOINES, IOWA.—Work has started on the foundation for the installation of the new 5000-kw. turbo-generator at the plant of the Des Moines Electric Company. A battery of boilers and a new switchboard will also be installed.

FORT DODGE, IOWA.—Bids will be received at the office of W. L. Tang, city clerk, Fort Dodge, until June 5 for furnishing material and erecting an electric transmission line in the city of Fort Dodge. Specifications may be obtained from Burns & McDonnel, consulting engineers, Inter-State Building, Kansas City, Mo.

MOREHEAD, IOWA.—At an election held recently the proposal to issue bonds for the installation of an electric lighting system was carried.

MOUNT VERNON, IOWA.—Preliminary plans are being prepared by the Wapsi Power & Light Company for an extension of its electric transmission lines out of West Branch, a distance of 8 or 9 miles, which will take in the villages of Centerdale and Springdale.

ST. LOUIS, MO.—The Union Electric Light & Power Company has awarded the contract for construction of a new substation, three stories high, to the Fruin-Colnan Construction Company of St. Louis. The station will be equipped with five 3000-kw. transformers and 30 outgoing circuits. The total cost of the work is estimated at $500,000.

BONESTEEL, S. D.—Plans are being prepared for the installation of an electric light plant and water works system. Bruce & Standeven, Bee Building, Omaha, Neb., are engineers.

LARNED, KAN.—Bids will be received by the Commissioners of Pawnee County, Larned, Kan., until June 26, for the construction of a court house, including electric wiring, heating, vacuum cleaner, ventilating fans, etc. The cost of the building is estimated at $125,000. W. E. Hulse & Company, National Bank Building, Hutchinson, are architects.

LONG ISLAND, KAN.—Bonds to the amount of $8,000 have been voted for the installation of a municipal electric-lighting system. The work will include the erection of a 13,200-volt, three-phase, electric transmission line (9 miles long) to connect with the electric plant at Phillipsburg; a pole type transformer substation will be built, equipped with three 10-kw. transformers and multiphase meter; the street-lighting system will consist of 22 series lamps with transformer, meter and time clock. The lamps will be suspended by cable over the center of the streets. The distributing system will cost about $2,000 and will include three 7½-kw., 2300-220-110-volt transformers and one 2-kw. transformer. About 75 buildings will be wired and the meters will be purchased by the city. Bids for the above work will be received by the city. Charles F. Sturtevant of Holdredge, Neb., is engineer in charge. Ira C. Young is Mayor.

McPHERSON, KAN.—Bids are being received by the Water and Light Department of McPherson for furnishing and installing a 250-hp. water-tube boiler and a 500-hp. open heater, with all small piping and attachments; also a steam-driven generating unit (directly connected) of not less than 300-kva. capacity, and switchboard panel with instruments and switches. Arthur Groesbeck is superintendent.

Southern States

RALEIGH, N. C.—Application has been filed with the Secretary of State by the Western Carolina Power Company for an amendment to its charter increasing its capital stock from $300,000 to $4,500,000 and removing its headquarters from Hickory to Charlotte.

CARTERSVILLE, GA.—Arrangements have been made whereby the Georgia Railway & Power Company of Atlanta will supply energy for operating the local system.

CHAUNCEY, GA.—The Georgia & Southern Utilities Company, recently granted a franchise in Chauncey, is planning to erect an electric transmission line to Chauncey and thence to Milan and Ryan, a total distance of 18 miles. The company proposes to construct an electric plant and develop about 200 hp. C. R. Hodgson of Eastman is manager. The company, it is understood, will do the work and no contracts will be awarded.

MILAN, GA.—The Georgia & Southern Utilities Company is contemplating extending its electric transmission line to Milan.

CHATTANOOGA, TENN.—The Chattanooga Railway & Light Company is planning to build at once an additional electric railway line to the Chickamauga Park Army Camp, following the Rossville Road.

COLUMBIA, ALA.—Work has been started on a hydroelectric development at Kelso, 2 miles west of Columbia. The proposed plant will develop from 5000 to 10,000 hp., which will be transmitted to Dothan, Headland, Newville, Ashford and Columbia in Alabama, and Blakely in Georgia. J. E. Foy and Dermot Shemwell of Lexington, N. C., are promoters. A company has been organized under the name of the Southeast Alabama Power Company to operate the plant.

OKARCHE, OKLA.—The installation of an electric lighting plant is under consideration by the City Council.

OKLAHOMA CITY, OKLA.—The State Capitol Commission is considering the construction of a power house and heating plant for the Capitol Building. A. N. Leecraft is secretary.

EL PASO, TEX.—Bids will be received at office of depot quartermaster, El Paso, Tex., until June 14 for alterations in construction and new electrical and pumping equipment at present pumping station, reinforced concrete reservoir and water pipe lines at Fort Bliss, Tex.

PAINT ROCK, TEX.—The Interstate Electric Corporation, which controls and operates the San Angelo (Tex.) Water, Light & Power Company, contemplates extending its electric transmission lines from Miles to Paint Rock, a distance of 18 miles, to furnish electrical service here.

Pacific and Mountain States

OHESAW, WASH.—The installation of an electric lighting system in Ohesaw is reported to be under consideration.

SEATTLE, WASH.—The Puget Sound Traction, Light & Power Company is planning to erect a substation at First Avenue South and Spokane Street, to be equipped with a 500-kw. motor-generator, to be increased to 1000-kw. The cost of the building and equipment is estimated at $12,000.

SEATTLE, WASH. — Work has been started to make surveys for the proposed power plant and nitrogen products plant of the American Nitrogen Products Company of Seattle on the Sauk Suiattle River in Snohomish County, 60 miles northeast of Seattle. The cost of the plant is estimated at $1,000,000.

SEATTLE, WASH.—The Board of Public Works has set July 20 as the date for opening bids for construction of the proposed addition to the municipal hydroelectric power system, and at this time bids from owners of power sites will be considered. In addition to the above, the following work is planned for this year by J. D. Ross, superintendent of lighting, as follows: Central substations, $50,000; distributing stations, $75,000; pipe line No. 1, $75,000; underground system, $400,000, and stores and shop buildings, $100,000.

SPOKANE, WASH. — The Washington Water Power Company will conduct tests on six new types of street lamps recently purchased by the city.

SPOKANE, WASH.—The Washington Water Power Company of Spokane is negotiating with mine operators on the north side of the Cœur d'Alene region to furnish them with energy for the operation of mines and mills. Line construction and transformer installation, it is estimated, would cost about $50,000. The several lines would have a total length of 25 miles. The service, it is stated, could not be furnished before next year, due to delay in obtaining transformers.

ASTORIA, ORE.—The Commissioners of the Port of Astoria have decided to install their own power plant to supply power for operating the machinery at the port elevator and coal bunkers.

FONTANA, CAL.—Plans are being prepared for the construction of a hydroelectric power plant for the Fontana Power Company, near Rialto, the initial installation to have an output of 18,000 kw. McKeen & Miller, Monadnock Building, Chicago, Ill., are engineers.

FRESNO, CAL.—The San Joaquin Light & Power Company is planning to double the output of its substation at Henrietta and is contemplating other improvements to its system. Work is under way on the construction of a new substation for the company at Chowchilla.

SAN BERNARDINO, CAL.—Work will soon begin on the erection of a mechanical plant in San Bernardino, to cost about $50,000. This plant is to handle all lines in southern California east of Upland.

VISALIA, CAL.—The Mount Whitney Power & Electric Company, it is reported, is making surveys for its proposed new power plant to be erected near the forks of Tule River, about 30 miles east of Porterville.

SALT LAKE CITY, UTAH.—The contract for erecting another electric transmission line from the Grace (Idaho) power plant of the Utah Power & Light Company to Salt Lake City has been awarded to the Phoenix Construction Company.

GOODSPRINGS, NEV. — Preliminary work has begun for the construction of a hydroelectric development on the Colorado River, just above Bend, to supply electricity for the Goodsprings and Yellow Pine District. It is proposed to transmit energy generated at the plant to many places in Arizona and in Nevada to points as far north as Ely and Pioche. Henry C. Schmidt of Tonopah is reported interested in the project.

Canada

PENTICTON, B. C.—The Canada Copper Corporation is planning to equip its mine at Copper Mountain for a production of 2000 tons daily. A power plant will be installed.

CAMPBELLFORD, ONT. — The Town Council has passed a by-law appropriating $19,000 for extensions and improvements to the electric-lighting and power system.

KINGSVILLE, ONT.—The local power plant and carhouse of the Windsor, Essex & Lake Shore Rapid Railway Company was recently damaged by fire, causing a loss of about $150,000.

ST. THOMAS, ONT.—The construction of an extension of the St. Thomas municipal railway to Pinafore Park is under consideration by the City Council.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing agent, the Panama Canal, Washington, D. C., until June 15 for furnishing electric cable and wire, battery zincs, detonators, transformers, electric motors, fiber duct, etc. Blanks and general information relating to this circular (No. 1147) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; Audubon Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, Arthur Kneisel, 29 South LaSalle St., Chicago, Ill.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Annual convention, Pittsburgh, Oct. 3-6.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual convention, Hot Springs, Va., June 26-29.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY OF TESTING MATERIALS, Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

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BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, E. Brettell, Electric Supply Company, Ltd., Vancouver, B. C.

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CANADIAN ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, Excelsior Life Building, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, F. D. Beardslee, Union Electric Light & Power Company, St. Louis, Mo.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Company, Schenectady, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF CONNECTICUT. Secretary, George M. Chapman, Waterbury, Conn.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia. Annual convention, Philadelphia, June 19-21.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, J. C. Staff, 578 Jackson St., Milwaukee, Wis.

ELECTRICAL DEALERS AND CONTRACTORS' ASSOCIATION OF ONTARIO. Secretary, E. A. Drury, 45 Murray St., Toronto, Can.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, H. B. Crouse, Crouse-Hinds Co., Syracuse, N. Y.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, 34 Ellis St., San Francisco, Cal.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago. Meeting, Hot Springs, Va., June 11 and 12.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Affiliated with the N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

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ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, R. H. Abbott, Petersburg, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, G. H. Stickney, Fourth and Sussex Sts., Harrison, N. J. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention, Newark, N. J., September.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF OPERATING ENGINEERS, Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 111 Broadway, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

IOWA SECTION, N. E. L. A. Secretary-treasurer, L. E. Caldwell, Iowa City, Iowa.

JOVIAN ORDER. Jupiter (president), Henry L. Doherty, New York City; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. A. Mercer, 108 West Eighth Ave., Topeka, Kan.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

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MICHIGAN SECTION, N. E. L. A. Secretary. Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, H. E. Young, Minneapolis General Electric Company, Minneapolis, Minn.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 14 Seventh St., N. Minneapolis, Minn.

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NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, H. C. Brown, 41 Martin Building, Utica, N. Y. Next meeting, New Orleans, October, 1917.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Bldg., Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee. Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. E. Egan, Room 201, Union Pacific Building, Omaha, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual convention, New London, Conn., Sept. 11-14.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST SECTION, N. E. L. A. Secretary, J. F. Farquhar, Washington Water Power Company, Spokane, Wash.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, June 12-15, Hotel Pontchartrain, Detroit, Mich.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary-treasurer, J. W. Oberender, 502 Dekum Building, Portland, Ore.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, Crossley Bldg., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION, State Section, N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa. Annual convention, Philadelphia, June 19-21.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, Thomas J. Styles, Room 2121, 165 Broadway, New York.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTH DAKOTA ELECTRIC POWER ASSOCIATION. Secretary, A. H. Savage, 1114 Pioneer Building, St. Paul, Minn.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, Thomas E. Peters, Columbus, Ga.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, H. C. Bower, 602 Metropolitan Bldg., Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Bldg., Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, Forrest E. Baker, 721 First National Bank Building, El Paso, Tex.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, Eugene Ashe, Dallas, Tex.

TRI-STATE WATER & LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West. Rutland, Vt.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 Jackson Bldg., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary. E. N. Layfield, 1735 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

1,226,627. RESISTANCE UNIT; Thomas E. Barnum, Milwaukee, Wis. App. filed May 11, 1914. Grid type.

1,226,635. ELECTROMAGNETIC VIBRATOR; Frank E. Brixius, Manitowoc, Wis. App. filed Aug. 21, 1916. For vibrating pattern plates disposed in molds.

1,226,639. ELECTRIC WELDING; Spencer C. Cary, Brooklyn, N. Y. App. filed Feb. 19, 1917. Two pressure and current-carrying electrodes are employed, both of which may be movable in a definite path relatively to the work.

1,226,696. THERMOSTAT - OPERATING CIRCUIT; Wellington A. Ramseur, Gainesville, Ga. App. filed March 9, 1916. For operating a valve for controlling the supply of water to a house or dwelling.

1,226,717. LIGHTING FIXTURE; Merton P. Stevens, East Orange, N. J. App. filed April 22, 1915. Means for holding a shade.

1,226,734. ELECTRIC - FAN ATTACHMENT; Willis I. Work, Boston, Mass. App. filed Dec. 5, 1914. To diffuse heat throughout a room.

1,226,748. SOLENOID; George A. Burnham, Saugus, Mass. App. filed July 1, 1915. Provides means to deaden or reduce the shock.

1,226,780. MULTIPLE REFILLABLE FUSE; Fremont J. Cleaver, Carnegie Borough, Pa. App. filed Oct. 5, 1915. Improvements.

1,226,795. INSULATOR PRESS; William Newby, Youngstown, Ohio. App. filed March 25, 1913. Improvements.

1,226,804. DRIVING MECHANISM FOR TREADLE-OPERATED MACHINES; Frederick J. Osius, Racine, Wis. App. filed Jan. 8, 1915. Such as an ordinary sewing machine.

1,226,808. SEALABLE FUSE PLUG; Clarence D. Platt, Bridgeport, Conn. App. filed Feb. 29, 1916. For the protection of small branch circuits.

1,226,813. ELECTRIC-WIRING CONNECTION; Harold Rowntree, Kenilworth, Ill. App. filed Dec. 3, 1914. Permits the ready and easy application of electric fixtures such as lamps, fan motors or the like at any desired location in a room.

1,226,816. PRIMARY BATTERY; Charles N. Schoenmehl and Martin L. Martus, Waterbury, Conn. App. filed May 15, 1916. Improved form of insulating block whereby the two electrodes may be insulatively secured together and suspended from a single suspending rod.

1,226,837. VARIABLE - RESISTANCE UNIT; Benjamin F. Williston, Detroit, Mich. App. filed May 17, 1916. Soldered joints are eliminated.

1,226,849. ELECTRIC WATER HEATER; Joseph B. Brookman, Manhattan, Nev. App. filed June 5, 1916. Provides safety means for operation when liquid is not being withdrawn from the tank.

1,226,901. SYNCHRONOUS DYNAMO-ELECTRIC MACHINE; Samuel H. Martin, Chicago, Ill. App. filed June 2, 1913. Improvements.

1,226,921. CONNECTION FOR ELECTRIC CONDUITS; George L. Stewart, Syracuse, N. Y. App. filed July 2, 1912. Guards against the entrance of moisture into the conduits at the joints.

1,226,925. DUCTILE FILAMENT; Orlando M. Thowless, Newark, N. J. App. filed Aug. 9, 1915. Free from all undesirable and deleterious substances and which shall not darken the containing bulbs while lighted.

1,226,926. ELECTRIC FLASHLIGHT; Joseph Tiscione, New York, N. Y. App. filed July 1, 1915. Pocket.

1,226,956. MERCURY MOTOR-METER; Albert L. Emens, Springfield, Ill. App. filed May 3, 1915. Provides a construction by which complete protection is secured against the loss of mercury through the armature shaft opening or passage.

1,227,012. FLASHLIGHT; Max H. Spielman, New York, N. Y. App. filed April 11, 1916. Avoids the usual thumb switch which is placed on the side of the cylindrical battery case of electric torch.

1,227,038. RESISTANCE UNIT FOR ELECTRIC CIRCUITS; William A. Chryst, Dayton, Ohio. App. filed Aug. 4, 1913. Adapted to be combined with the circuits of an ignition system.

1,227,091. SPEED-REGULATING APPARATUS; John B. Taylor, Schenectady, N. Y. App. filed Dec. 1, 1914. For use with musical instruments.

1,227,111. INSULATOR - BLOCK CABLE BRACKET HANGER; Ellsworth J. Burdick, Detroit, Mich. App. filed June 4, 1915. Protects the armor of a supported cable from contact with the bracket or cable support and against all stray currents, auto-electrolysis or galvanic action that might otherwise take place.

Record of Electrical Patents

Notes on United States Patents issued on May 22, 1917

1,227,149. METHOD OF CHARGING SECONDARY BATTERIES; Edward B. Jacobson, Pittsfield, Mass. App. filed Dec. 3, 1913. "Foolproof."

1,227,177. MOTOR CONTROLLER; Niels L. Mortensen, Milwaukee, Wis. App. filed Nov. 15, 1911. Control of electric motors used for hoisting and lowering where dynamic braking and power reversal or kick-off are desired for lowering.

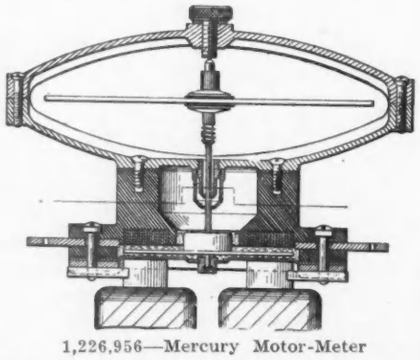
1,227,185. INDUCTION DEVICE; Alfons H. Neuland, New York, N. Y. App. filed Sept. 1, 1915. Will change the low torque and high speed of the driven shaft.

1,227,195. PUSH-BUTTON SWITCH; Clarence D. Platt, Bridgeport, Conn. App. filed March 17, 1914. Single or multiple-pole design.

1,227,210. METHOD OF OPERATING FLAMING-ARC LIGHTS FOR PROJECTORS; Elmer A. Sperry, Brooklyn, N. Y. App. filed June 28, 1915. Employs a direct-current arc of a different sort and possessing very different qualities from the direct-current arcs ordinarily used.

1,227,211. MEANS FOR PREVENTING CURRENT LEAKAGE IN ELECTRIC CABLES; Severn D. Spring and Walter E. McCoy, New York, N. Y. App. filed Dec. 12, 1916. Improvement.

1,227,228. CUT-OUT FOR ELECTRIC STERILIZERS; William L. Woerner, New York, N. Y. App. filed Jan. 13, 1915. Means for interrupting or breaking the electric circuit serving to energize the heating element.



1,226,956—Mercury Motor-Meter

1,227,230. ELECTRIC PUMP GOVERNOR; Burton S. Aikman, Milwaukee, Wis. App. filed Dec. 24, 1914. Governor in which no movements of the parts takes place until the predetermined maximum and minimum pump pressures are reached.

1,227,241. ELECTRICAL APPLIANCES; Carl J. Bissell and Elda S. Smith, Syracuse, N. Y. App. filed Aug. 7, 1914. Adapted for storage-battery charging stations in railroad terminals and coachyards.

1,227,256. MULTIPLE-FUSE PLUG; Frederick A. Feldkamp, Newark, N. J. App. filed Jan. 18, 1916. Stationary base member and a member axially movable and rotable with respect thereto.

1,227,270. CIRCUIT-CLOSING PUSH BUTTON; Robert J. Jackson, Philadelphia, Pa. App. filed April 17, 1916. Uses a brass coil spring.

1,227,286. DRAFT INDICATOR; John Maher, Cleveland, Ohio. App. filed July 6, 1914. Provision of a wholly automatic control instead of a co-operating manual control.

1,227,295. STORAGE-BATTERY ELECTRODE OR GRID; William Morison, Des Moines, Iowa. App. filed Aug. 8, 1913. Maximum of surface exposed to the electro-chemical action for a given weight of metal.

1,227,302. MEANS FOR CONTROLLING ALTERNATING CURRENTS; Mendel Osnos, Berlin, Germany. App. filed July 8, 1915. Improvements.

1,227,314. TRANSFORMER; Emerson G. Reed, Wilkinsburg, Pa. App. filed Nov. 5, 1913. Insures adequate cooling for the transformer coils and at the same time will require a minimum amount of active material.

1,227,320. DEMAND APPARATUS; Lewis T. Robinson, Schenectady, N. Y. App. filed Sept. 29, 1916. For recording the character and magnitude of the demand made by an electrical installation upon a certain generating station.

1,227,321. REGULATOR FOR DYNAMO-ELECTRIC MACHINES; Paul Rose, Berlin, Germany. App. filed Feb. 20, 1911. Contact-making regulators.

1,227,324. AIR HEATER; Percy Russell, Brooklyn, N. Y.; Frank J. Sepas, Philadelphia, Pa., and Edward B. Wilford, Merion Borough, Pa. App. filed Jan. 30, 1914. Heats a flowing body of air as required in dental syringes and like instruments.

1,227,326. ELECTRIC TIME SWITCH; George E. Schindler, Ashland, Wis. App. filed Aug. 9, 1916. Movable elements are so associated as to minimize the resistance to the flow of current.

1,227,341. ELECTROMAGNETIC DEVICE; Harry F. Stratton, Cleveland, Ohio. App. filed Dec. 22, 1915. Means for accelerating the decay of magnetism in the magnetic circuits of such devices upon their de-energization.

1,227,367. LATCHING AND TRIPPING MECHANISM; Victor S. Beam, Maplewood, and Ernest C. Otto, Elizabeth, N. J. App. filed Oct. 2, 1913. For circuit breakers.

1,227,385. CIRCUIT-INTERRUPTING MEANS; Frank E. Case, Schenectady, N. Y. App. filed June 29, 1914. Particularly concerned with the mounting and inclosure of such means.

1,227,400. ELECTRIC MOTOR; Michael Dolivo-Dorbowolsky, Wilmersdorf, Germany. App. filed March 25, 1914. For driving a lock mechanism.

1,227,404. EXPANSION CHAMBER FOR ELECTRICAL APPARATUS; Delafield Du Bois, New York, N. Y. App. filed Nov. 1, 1913. Provides for the free normal expansion and contraction of the materials within the tank as their temperature changes in such a manner that it is impossible for the outside air to reach the fluid of the tank.

1,227,414. DYNAMO-ELECTRIC MACHINE; Allan B. Field, London, England. App. filed Dec. 31, 1913. Magnetizable core for dynamo-electric machines which shall permit of ready and rapid winding of the coils therein and shall embody means for easily and securely maintaining the coils in position.

1,227,415. TRANSFORMER; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed Aug. 7, 1911. Three-phase transformer which shall be so arranged and proportioned as to utilize its magnetizable core member to a maximum extent.

1,227,417. CIRCUIT-INTERRUPTING DEVICE; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed June 30, 1915. Automatic means for interrupting a circuit upon either the occurrence of a short circuit or a gradually increasing overload.

1,227,433. RELAY; Max Hartenheim, Pittsburgh, Pa. App. filed Aug. 10, 1915. Hot-wire relays that are utilized for controlling the operation of dynamo-electric machines.

1,227,434. SWITCHING DEVICE; Stephen Q. Hayes and Charles McL. Moss, Pittsburgh, Pa. App. filed May 1, 1913. Swinging-blade disconnecting switches.

1,227,468. ELECTRICAL MEASURING INSTRUMENT; Paul MacGahan, Pittsburgh, Pa. App. filed May 1, 1913. Bearings and pole pieces which are simple and inexpensive to construct.

1,227,479. RELAY; Paul MacGahan, Pittsburgh, Pa. App. filed June 11, 1915. Object is to provide a relay having time element.

1,227,472. CIRCUIT INTERRUPTER; Joseph N. Mahoney, Wilkinsburg, Pa. App. filed Sept. 28, 1912. Auxiliary devices which may be employed for actuating the movable parts of the interrupter with great rapidity.

1,227,488. ELECTRIC COOKER; Stanley B. Oakes, Flint, Mich. App. filed Jan. 17, 1916. Toasters.

1,227,529. RADIATOR-HEATER; Albert R. Clarke, Sheridan, Wyo. App. filed Feb. 21, 1916. Relates to combustion engines, and particularly to the cooling systems thereof.

1,227,538. FLEXIBLE ELECTRICAL CONDUIT; Courtney Hyde, Brooklyn, N. Y. App. filed March 15, 1916. Does not include as an element a supporting helix of semi-flexible material.

1,227,553. PLURAL LAMP SOCKET; Adolph C. Becker, Oakville, Conn. App. filed March 2, 1917. Avoids the use of assembling screws.